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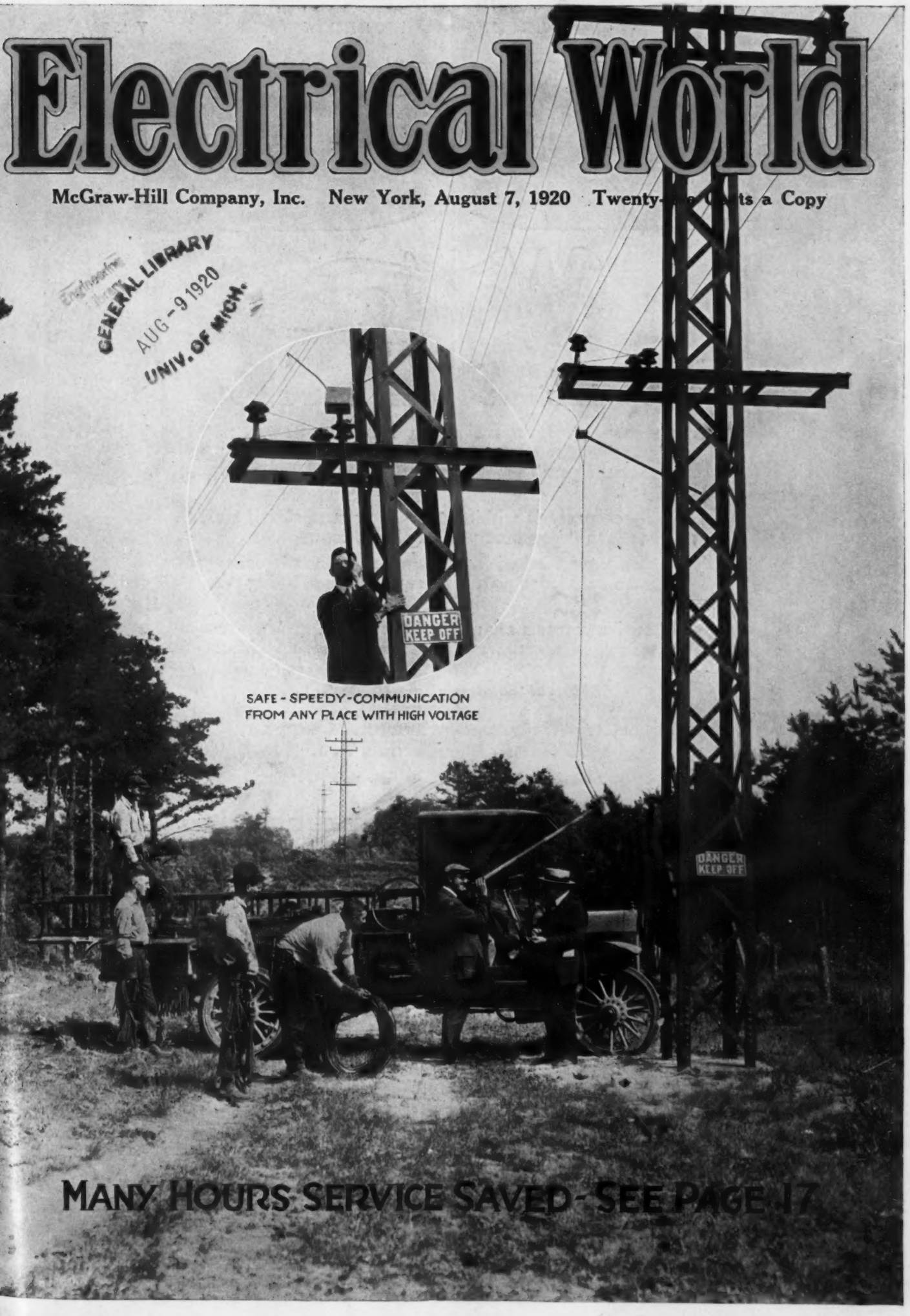

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FROM ANY PLACE WITH HIGH VOLTAGE

MANY HOURS SERVICE SAVED - SEE PAGE 17

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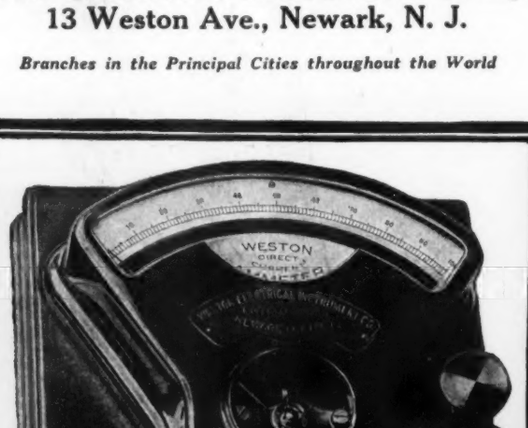

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Electrical World

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Volume 76 New York, Saturday, August 7, 1920 *Number* 6

The Engineer's Police Duty

HESITANCY of bankers and bonding houses to advance money for hydro-electric developments is often due more to misgivings caused by past misrepresentations than to the rate of return which is offered them. To facilitate legitimate developments it is the duty of the engineering fraternity as a whole to expose unsound projects. The industry cannot wait for some one else to do its policing.

Coal Regulation

THE coal producers of the country are playing a fast and loose game with consumers which can have but one ending. At present the game is all their way. Fortune favors them, and if one wants coal he must pay the price or go without. But from a public policy angle such an attitude is nothing short of suicidal. Coal production is not an amusement resort attraction, depending upon claptrap and chicanery for existence. It is a vital business dealing with an important and basic product which is essential to almost every other business in existence. For that reason producers cannot lightly regard adverse public sentiment, and this is fast building against them, owing to the unconscionably high prices for coal now prevailing. Unheeded, this sentiment will cause the game to be abruptly ended, and coal producers will find themselves bag and baggage in the hands of a regulating commission. All industry, and particularly public utilities, will demand it. This, of course, is the last thing the National Coal Association wants, but the road on which it is now traveling leads that way.

Strikes and Public Utilities

FIFTEEN hundred and sixty-four of the bodies making up the United States Chamber of Commerce have voted for and only ninety-seven against a declaration of principle averring that strikes of employees of public service corporations should be prohibited by law. By an equally emphatic vote the creation of tribunals to adjudicate labor disputes affecting such corporations, the decisions of these tribunals to be final and binding, has been indorsed. In making these declarations the Chamber of Commerce is merely registering what has long been the conviction of business circles—a conviction shared very generally by the people at large, whose "lives, health, security, comfort and well-being" are threatened and interfered with every time such a strike takes place. It is the good fortune of electric light and power companies that their interest in this particular phase of the activities of the Chamber of Commerce is that of good citizenship rather than that of participants in such struggles. For, thanks to the loyalty, high intelligence and public spirit of their employees, strikes are almost unheard-of happenings with them and the better way of negotiation and mutual concession has been long an accomplished fact.

"Foolproof" Electrical Apparatus

THE electrical engineer of a well-known automobile company makes the statement that owing to ignorance and incompetency the labor of keeping electrical equipment in first-class shape has increased fourfold. Obviously, then, the remedy lies in making all electrical apparatus as nearly "foolproof" as possible. To do this requires simplification of control and the use of automatic devices with push-buttons for starting and stopping motors and for closing switches of all types where power in any quantity is involved. Educational propaganda may also help, but its efficacy is dubious if labor is too ignorant to learn or cares little for consequences. "Foolproof" apparatus is the surest solution of the problem involved.

Insulators for Higher Voltages

FROM a Western viewpoint the question of going to higher transmission voltages is not an abstract proposition. With one large company having already ordered transformers wound for 220 kv. and others installing lines to operate at voltages above 150 kv., there is an immediate need for intensive study of the insulation requirements of such lines. Studies of the results to be obtained from the use of shields have been made by independent investigators, who have arrived at the conclusion that strings of suspension insulators shielded by metal plates or antennas may have the electric stress so distributed that no unit in a 220-kv. string will have greater unit duty than the same string used unshielded on a 150-kv. line. The particular type of shielding is of comparatively small importance, but the fact that a solution of this pressing problem is at hand is of intense interest to transmission engineers.

Rural Service Needs Study

HOW the rural line extension shall be handled has become an exceedingly pressing question, particularly in the Middle Western States, where the agricultural industry dominates the field, and where, unlike the Eastern States, industrial applications have not completely absorbed available central-station capacity. The farmer is not only demanding service but in many localities is able and willing to pay any reasonable price to get it. Present methods are very much confused because of the rapidity and magnitude of the development, but there are several tendencies that should receive the close study of central-station managers if serious errors are to be avoided. One of these tendencies is the character of construction. There is a tendency in some quarters to resort to extremely light construction or questionable engineering practices

on the assumption that first cost must be at the lowest possible level. While low first cost is essential, it must not be attained at the expense of safety and the imposition of heavy future maintenance charges that will be many times the fixed charges on the extra cost required to put up substantial construction. A tendency toward the creation of mutual organization or rural utilities that will operate and maintain their own distribution lines is observed. The experience of the rural telephone companies can be profitably studied in this connection. Rural companies cannot be expected to have an adequate working knowledge of the systems they attempt to operate, nor can they afford to employ a staff that has the necessary qualifications. From the trend in some localities it appears that the problem may be solved by an arrangement whereby the farmer makes the necessary investment, turning the lines over to the utility for future operation and maintenance and paying a fixed charge in addition to the energy charge that will be sufficient to cover depreciation and the maintenance and operating charges that may be in excess of the similar charges for city or town service.

The question of rates has perhaps so far received the most attention, but for the moment it would appear that the questions of character of construction and methods of financing and operating lines are of first importance, for on the answer to these questions depends the answer to the question of rates, which it is admitted must be sufficient to cover the cost of service and afford a reasonable profit. Present light and power rate schedules have been largely built up on city and town service conditions. Some have already made the error of attempting to establish rural service rates on that basis and are finding that the rates so fixed do not fit at all.

It appears now that the rural distribution line is a development that cannot be denied. Whether or not that development will be retarded and agricultural development hindered depends on the thoroughness of central-station men in working out the development problems with the various state commissions and prospective rural consumers. Several state commissions with the assistance of the utilities of their states are already earnestly at work on the problem, and it may be in order to suggest that the National Electric Light Association can very profitably take hold of the subject from a national viewpoint.

Isolated-Plant and Central-Station Costs

ONE striking result of war-time conditions has been the great increase of industrial service on the part of central stations and a very formidable concurrent increase in the price of fuel. Now, as fuel goes up highly efficient power plants gain increasing advantage, and hence central stations are more than ever able now to take over isolated plants which previously were operating at figures nearer to a real competitive basis. The central stations, with some loss of industrial patronage owing to the shutdown of war-time plants, are well equipped to take care of their customers and to take on the additional load to be furnished by the larger class of isolated plants. The central station of course has also to pay more for its coal than it used to, but utilizes it at much higher efficiency than is feasible in the isolated plant. The data available seem to indicate that, with fuel prices anywhere near the present level, nothing short of a superefficient isolated plant can be economically operated where central-station power is available at the usual rates.

Feat in Reducing Costs

IN THESE days, when the cost of everything is climbing inconceivable grades on high gear, it is almost astounding to find that by careful organization and the introduction of labor-saving schemes the Commonwealth Edison Company has been able to keep its service installation costs for the last year actually below prewar figures. D. W. Roper's account of the way in which this remarkable feat was accomplished is worth careful consideration as showing how many loose ends can be pulled up in construction work and how straightforward a proposition services actually become when the working plans are carefully made. Among the many details which Mr. Roper reports some stand out conspicuously. First, the elimination of a very large proportion of rush orders is a gain of no small magnitude. Rush work is notoriously expensive, and when it involves disturbance of the regular schedule as well as extra costs in transportation it becomes singularly burdensome. Of course, now and then it has to be undertaken, but where the general installation work is carried on in an orderly manner the average time required for completion comes down quite nearly to the basis of a rush order. Beyond this the change in practice most conspicuous is the service of the work dispatcher in routing and handling the construction parties. The plan of campaign is worked out in advance. The routes for the several gangs are laid out so that each will start at the furthest point from headquarters and work back through the day. More than this, the men report in the morning at the job set for the beginning of their day's work, a provision which impresses us as being one of the most important in the whole schedule of economics. So much for the principal features of the human side of the task.

Next in importance comes the introduction of standardized methods in working out the details of an installation, that particular type of service being selected for general use which proved to make the easiest and most straightforward job. This being done, the equipment, tools and material could also be standardized so that each regular crew would have a uniform equipment containing everything necessary to carry on the work, without the casual additions that are likely to come when the exact method of procedure is left to be determined on the work. This entire equipment was packed in a uniform type of construction wagon, each article going into a space just fitted for its reception. This precaution insures the greatest possible ease in getting at anything which is required and eliminates grubbing around in the bottom of a wagon for an article thrown into it without any plan. On the average, the standard equipment of stock and tools is five hundred pounds lighter than the miscellaneous collection which used to clog the wagons, and this again facilitates getting promptly on the job. Gradually, too, various ingenious details of construction have been worked out and made a regular part of the program to save time and cut down waste of material. The complete list of equipment which Mr. Roper tabulates speaks volumes for the thoroughness with which the whole

operation is planned, and finally the clerical routine of reporting and executing orders has been simplified so that the foreman can attend strictly to his business without scribbling in the field a lot of entries for which there is no absolute need when proper provision is made at the office for reporting the essentials. The result of this admirably planned campaign of installation has been, as already said, actually to bring the costs of this item below pre-war figures and so to recoup in part the heavy expenses which have been loaded upon public utilities by increases of prices which no foresight or skill can escape.

Protection of Transmission Systems

HIGH-VOLTAGE transmission systems are subject to various troubles, all of which have to be considered by designers and operating engineers, while some of them have to be specially protected against. There are insulator breakdowns due to insufficient factor of safety in the insulators, power losses by corona, groundings of the lines by casual storm damage, poor voltage regulation, harmonics, short-circuit impacts on generators, losses of synchronism, overvoltages due to lightning and arcing grounds. In this number we print a contribution by Prof. Emil Alm which is particularly directed to protection against lightning surges and arcing grounds, with especial reference to the 100-kv. Untra-Värtan transmission system in Sweden.

In order to discharge the steadily increasing atmospheric accumulations of electricity on the lines, the neutral points of the three-phase transformers are permanently grounded. On the other hand, in order to limit short-circuit currents due to accidental grounds, neutral-point resistances to ground are inserted. Consideration is given to the proportioning of these resistances, so as to produce the best compromise between prompt discharge through a low-resistance path, and checking short-circuit currents by increasing the resistance.

It is claimed that there is a distinct advantage in the substitution of inductance for resistance in the neutral-to-ground paths, particularly in suppressing arcing grounds. This is an interesting point, on which experimental information, as well as practical experience, would be welcome. In the system described by the article, however, we understand that these neutral-to-ground impedances are conductive and not inductive. The high-tension busbars appear to be of stout iron pipe, instead of the usual copper.

The effects of the surge reflections as they enter from the line and develop in the protective devices are estimated in some detail. This method of computation is somewhat novel, but it is likely to receive much development in the future. In the radio art these oscillations are fostered and encouraged for the purpose of obtaining from them the communication of intelligence which they bear. In the power-transmission art these oscillations are suppressed and discouraged as much as possible, on account of their possibilities for danger. Means should be found for recording, oscillographically and automatically, the surges which come into a power house from the incoming lines, so that their properties may be studied and understood at leisure. The most troublesome oscillations arrive so swiftly and suddenly that the ordinary oscillograph is incapable of recording them properly.

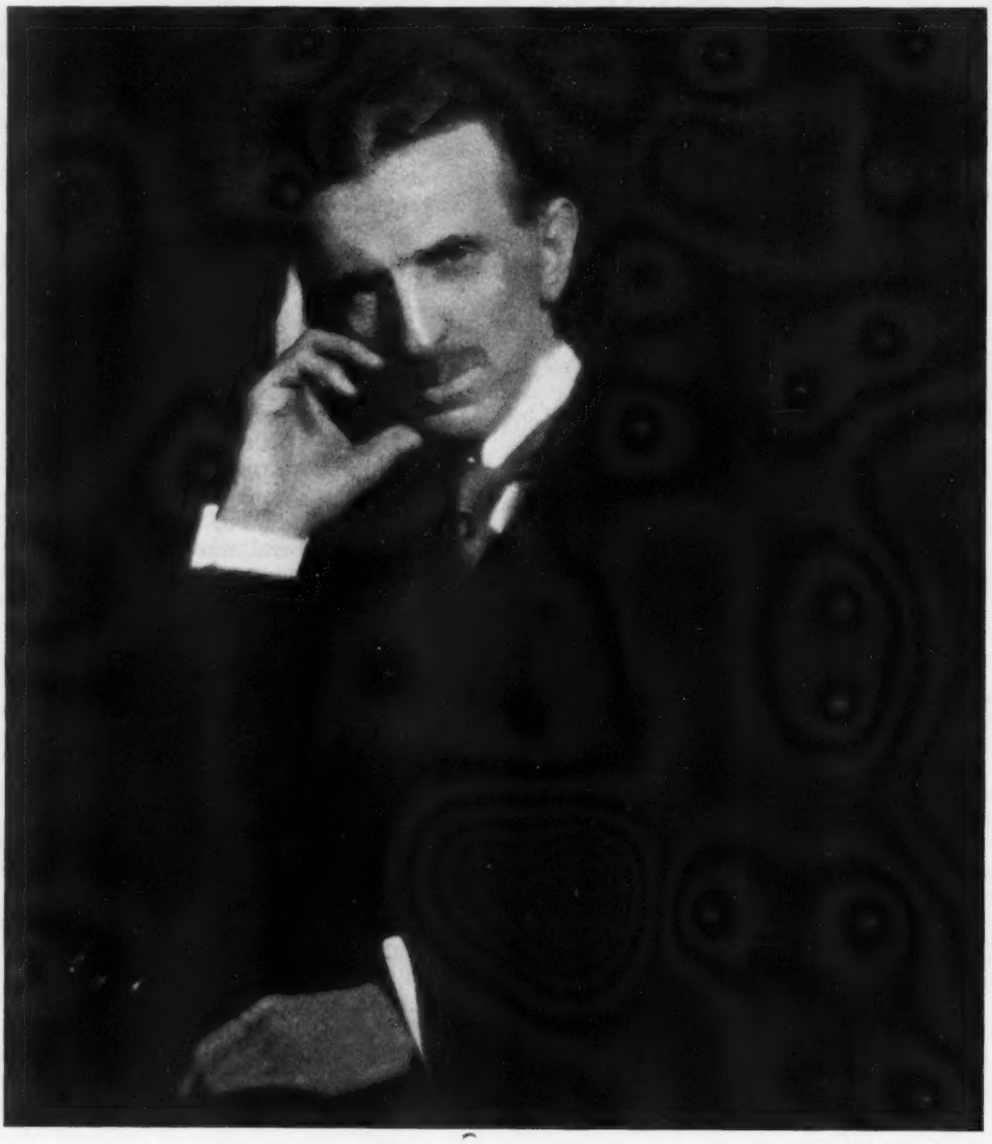
Difficulties of Waterwheel Regulation

AS BITTER experience has taught, speed regulation in hydro-electric plants is no joke, especially when big machines are operated in parallel. The fundamental difficulty is the sluggishness and immense inertia of the moving fluid, more particularly in the case of rather low-head installations, resulting in a time constant of regulation which is often inconveniently large. In the current issue C. F. Mosher discusses in an illuminating manner some of the general problems of regulation as they present themselves in practice. In these days of sensitive relay governors a wheel at constant or slowly changing load can be held at constant speed very closely. It can even be set to hold speed quite accurately from no load to full load, as regards gradual change. But the more nearly it does this the more delicate must be the setting and the greater the danger of trouble in case of a quick change of load. If the governor is sluggish, the risk of pressure changes is reduced at the expense of varying speed; if it be quick-acting, it will hold speed better, but the stresses may become disastrously high, and when generators are operating in parallel there may be instability and hunting. In these respects one finds himself between the devil and the deep sea.

As Mr. Mosher indicates, too close inherent regulation is risky; but the main difficulty resides in dealing with rather rapid changes of load, especially with turbines at moderate heads. With impulse wheels under high head using the deflecting type of regulation, a well-balanced nozzle will act very promptly; but it should be noted that this system is very wasteful of water, and the use of needle valves or their equivalent brings again grave stresses requiring very complete provisions for relief. With ordinary turbines the greatest freedom of action comes with an open-flume setting, which as a general proposition is impracticable, and difficulties increase with the length of the penstock and draft tube.

Good as modern waterwheel governors are, there is still room for improvement in the matter of adjustment to the actual load conditions of the system. Two things in particular have to be taken into account—first, the range and time relations of ordinary changes of load; second, the effect of violent changes such as may be produced by a short circuit or open circuit. The former class can be well taken care of by adjustment allowing a moderate speed variation with respect to the time constant of the hydraulic system; the latter demands emergency measures both electrical and mechanical. This combination cannot easily be worked out *à priori*. Still again the operation of hydro-electric and steam plants in parallel brings a new set of problems, fortunately often simplified by the cushioning effect of a long connecting line.

In the long run security from grave difficulties in governing comes not only from good design and adjustment but from the increase of interconnection, giving steadier load conditions and allowing a unit in trouble to drop out of the system without producing serious load changes. It is the violent change that brings danger; for the rest a moderate variation in speed, if gradual, produces little disturbance in service, and on the whole a governor too sensitive is more to be feared than one which has more deliberate operating characteristics.



Nikola Tesla

Inventor of the alternating-current motor, pioneer in high-frequency investigation and discoverer of numerous fundamental principles in electricity

ALMOST a third of a century has passed since Nikola Tesla announced his discovery of the alternating-current motor, but the principles then enunciated by him will be found in force today wherever alternating current is used. Little things frequently lead to important consequences, and the way in which Tesla was led to his discovery is an exemplification of this trite observation. He was a student in Grätz, in Austria, when he became annoyed by the sparking of a small laboratory generator, and the idea came to him that a commutatorless dynamo might be possible. This thought grew upon him, but not until four years later did he make any progress toward its realization. Then the solution suddenly came to him during a moment of recreation. In Europe it was impossible to interest capital in his discovery, so in 1884 he came to America, where his fame had preceded him. His first employment was with Edison.

He was able later on to attract capital, and in 1887 he organized a company to further his cherished plans, on which he worked nineteen hours a day. The next year, upon the issuance of the patents, he announced the discovery which was destined to have such a profound effect upon the rapid expansion of the use and application of electrical energy.

Next to this work in polyphase power transmission his researches in the field of high-frequency oscillations are probably of greatest importance. His discoveries in this field include among others the oscillation transformer, the electrical oscillator and the Tesla tube. Work on these lines led quite naturally to his investigations in the field of radio power transmission. In addition he has made various other scientific investigations, especially in the fields of low-weight, high-powered prime movers and atmospheric nitrogen production.

Mr. Tesla was born of Serbian parents at Smitjan, Lika, in Austria-Hungary, in 1857. He studied engineering at Grätz, Prague and Budapest. In 1917, on the twenty-ninth anniversary of the reading of his paper before the American Institute of Electrical Engineers, announcing his discovery in polyphase transmission, he received the Edison medal for "early original work in polyphase and high-frequency electric currents."

Service Work for 1919 Below Pre-War Cost

In Spite of Increased Wages and the Inroads of War and Industry on the Ranks of Trained Workers, Careful Engineering Has Succeeded in Reducing Unit Costs —Important Factors That Have Played a Part in Bringing This About

By D. W. ROPER

Superintendent of Street Department Commonwealth Edison Company

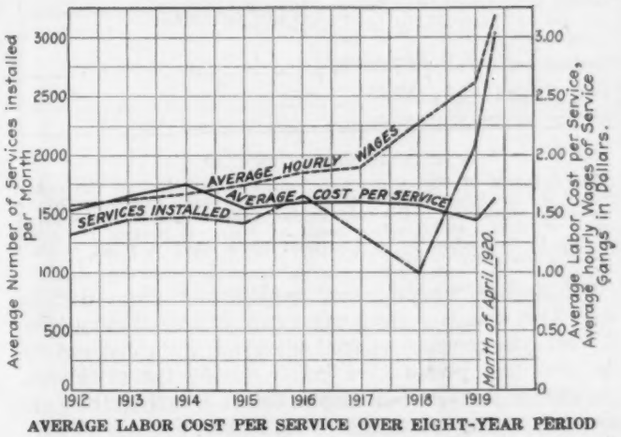
THAT the street department of the Commonwealth Edison Company of Chicago has been able to make a reduction in overhead service costs, as shown in the accompanying curves, in spite of the increased costs of labor, has been due to the carefulness with which efficient working methods have been carried out. At first glance it may appear that the increasing number of services installed per year is a large factor in reducing the cost per service. This, however, is not the case, as may be observed by studying the dip of the "service installed" curve in 1917. It is a fact that the number of services installed does have some effect on the cost per service, but, as shown by the data making up these curves, it is a very small factor. There are other factors which are more potent and the net result is achieved only by the combined effect of all.

Some of the important factors that have helped to effect this reduction can be briefly summarized as follows:

1. Eliminating rush orders.

2. Scheduling services. More than 80 per cent are installed within three days of the time the order reaches the street department.

3. Standardization of the overhead-line equipment.



AVERAGE LABOR COST PER SERVICE OVER EIGHT-YEAR PERIOD

During the period shown the average wages of the gang have increased from $1.56 to $3.20 per hour, an increase of 105 per cent. Had the average labor cost of service installations increased in the same ratio, the labor cost per service would have been $3.12 in place of $1.56. During April 3,033 services were installed, on which the saving at $1.52 per service amounts to $4,730. In April there were twenty-six working days so that the average daily saving during the month of April due to the methods herein described was $182 per day.

4. Improved form of wagon for service and petty repair work. Some of the boys call it a "kitchen cabinet on wheels."

OVERHEAD DAILY REPORT - SERVICE GANG — DIST 3 — DATE April 14, 1920.

STOP NUMBER	SECTION NUMBER	ORDER NUMBER	ACCOUNT TO BE CHARGED	LOCATION	MILES TRAVELED TO JOB	TIME ALLOWED TO JOB	TIME OF ARRIVAL	TIME OF DEPARTURE	* TIME ON JOB	* TIME ALLOWED TO JOB	ITEMS OF WORK DONE: EXTRICES	ARMS	SPANS OF WIRE	TRANS. LIGHTNING ARRESTORS	CROSSARMS	CUTS	ANCHORS	EXPENSE
1	820	8812	252A	7950 Jeffery Ave.			8:00	8:30	30	30	I-2							5
2	792	8543	"	7609 Luella Ave.	3/4	10	8:40	9:00	20	30	I-2							
3	792	8542	"	7605 " "			9:00	9:20	20	20	I-2							
4	793	8544	"	7601 " "			9:20	11:00	100	100	I-2	I-2	I-2			I-1		5
5	792	8540	"	7646 Merrill Ave.	1/4	5	11:05	11:45	40	45	I-3	I-1				I-1		
6	791	8648	"	7707 Cregier Ave.	1/2	5	11:50	12:45	25	30	I-2							5
7	762	8442	"	1518 E. 72nd Pl.	3/4	10	12:55	1:20	25	35	I-2							
8	761	8270	"	7205 University Ave.	1/2	10	1:30	1:55	25	35	I-2							
9	761	8272	"	7345 Greenwood Ave.	1/4	5	2:00	2:25	25	30	I-2							
10	789	8577	"	7817 Drexel Ave.	1/2	10	2:35	3:00	25	35	I-2							
11	788	8576	"	7632 Rhodes Ave.	1/2	10	3:10	3:40	30	40	I-2							5
12		S.R.O. 4-21-2	650B	7632 Sugleside Ave	1/2	5	3:45	5:00	75	80	Rerouted							
TOTALS						*70			440	510								*.10

Time of arrival — NAME — DATE — TOTAL HRS. / TOTAL AMT. — EXPENSES: CAR FARE TEL. / MEAL A.M. / MEAL P.M. / OVER TIME NO. MEN — DISTRIBUTION OF ACCOUNTS: * ACCOUNT / * HRS. / AMT. / ACCOUNT / HRS. / AMT.

Breckenridge, H.	7:30	8½		.20			252A	5½		
Klimcke, W. (1)	7:30	8½					252A	1		
Metz, P. (2)	7:30	8½					656	1½		
Davis, J.	7:30	12					646A	½		
TOTAL LABOR AND EXPENSE		84		.20				8¼		

XXXXXX ELECTRIC — NUMBER 87 — OWNED CE

REMARKS: Practiced Prone method of resuscitation from 4:45 to 5:00 P.M.

TIMEKEEPER — RECORD SECTION — Breckenridge LINE FOREMAN — GENERAL FOREMAN — FOR FURTHER REMARKS SEE OTHER SIDE

FORM O. U. 68 COMMONWEALTH EDISON CO.

OVERHEAD SERVICE ORDER TO STREET DEPARTMENT

DATE Apr-16-20.

TRANSFORMER NO. 3934 D. O. NO. 24958

DISTRICT 1 SECTION 247

NAME Henry Snedeman.

ADDRESS 2830 N. Robey St.,

LOAD 17 lts.

INSTALL 2 NO. 8 WIRES ON A SIDE OF S. M.

FROM 5 K. W. TRANSFORMER.

LOCATION 4th Pole S.E. of George, Al.N.E. of Clybourn.

9149

DISTRIBUTION ENGINEERING DIVISION

SERVICE WANTED ON

BY SHM: MO

REPORT

WORK ORDERED ABOVE HAS BEEN INSTALLED AS INDICATED BELOW AND AS SHOWN IN SKETCH ON REVERSE SIDE OF THIS REPORT.

INSTALLED 2 NO. 8 WIRES ON A SIDE OF S. M.

FROM K. W. TRANS. NO.

LOCATED Same as above

WORK DONE 4-19 1920 BY Leuseberg

STREET DEPARTMENT E.E.S.

BY

WORK RECORDED — DRAFTING DEPT.

COMMONWEALTH EDISON CO. FORM I 67 CHICAGO

AT LEFT, OVERHEAD DAILY SERVICE REPORT OF SERVICE GANGS.

Typewritten entries are made in the office the day previous to issuing to foreman. Additional items of work given over the telephone are written in by the foreman, who also fills out the various columns giving details regarding work done and other items. All columns marked with an asterisk (*), showing the distribution of time to the various accounts and other items, are filled out in the street department office, and the extensions are figured and entered by the timekeeping department. The following abbreviations are used: "I" means installation; "R" means removal; "X" means replacement, and "M" means relocation of equipment.

AT RIGHT, OVERHEAD SERVICE ORDER TO STREET DEPARTMENT

For the overhead service order the typewritten entries are made in the office. Three copies of the order are sent to the street department; one is retained in the general office for their follow-up record, and two are sent to the district office; one copy is used for office record and one issued to the foreman, who enters in pencil his report of work done. On the back of the report he makes only a simple pencil sketch showing the location of the work done by the gang. Occasionally the service gangs install one or two spans of line wire which are also indicated on the back of this report and later entered on the permanent record by the engineering department.

SPECIAL ATTENTION

NAME OF CUSTOMER Van Buren Wet Wash Co.

ADDRESS 3521-27 Harrison St.

DATE SERVICE IS PROMISED Saturday, April 17, 1920.

AGREEMENT BY J.W. Ferguson.

POSSIBILITY OF ACCOMPLISHMENT VERIFIED BY J.F.Rice.
HEAD OF DEPT. OR FOREMAN

APPROVED BY J.W.Ferguson.

DATE April 16, 1920.

FORM C 111 COMMONWEALTH EDISON CO.

SPECIAL ATTENTION SLIP

The original of this slip when issued is attached to the order sent to the engineering department. Typewritten copies are made there and attached to the installation orders sent to the several divisions of the street department so that all parties handling the job in the office or in the field know that it must receive special attention.

5. Standard wagon stock replenished from day to day. This standard stock takes care of all ordinary jobs. If some job requires special material, it is ordered by the office and placed in a locker during the afternoon. The driver puts on his wagon before starting the next morning all the material in that locker.

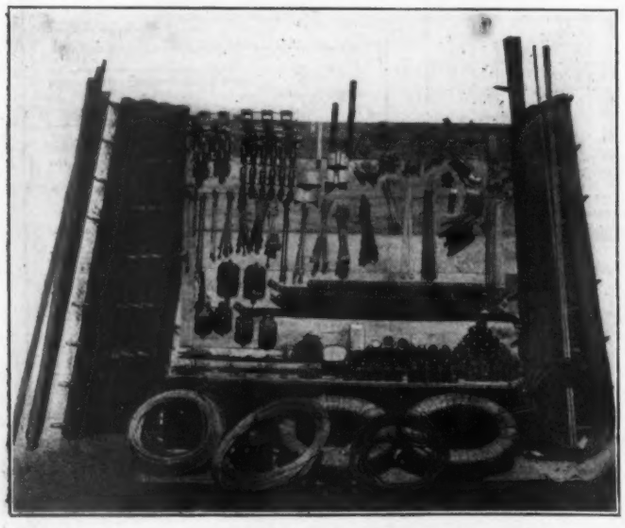
6. A typewritten form of order which eliminates most of the clerical work formerly requested of the foreman and simplifies the reporting.

7. Routing of services by the office so as to reduce traveling time.

8. Proper charging of time with careful supervision by office to insure accuracy.

9. Daily analysis of service costs of each gang to detect and eliminate cause of loss of time or other items increasing the cost.

Of course, the full effect of all of these causes for reduced cost was not realized overnight. Each is an achievement resulting from considerable earnest work by the street department employees. However, the whole movement started ten years ago when the then existing Western District, Northern District and Southern District offices were abolished and replaced by a department organization. This was in the year 1910.



STANDARD STOCK OF MATERIALS FOR OVERHEAD SERVICE TRUCKS

Foreman calls work dispatcher on telephone in afternoon and states what material has been used during the day. Work dispatcher arranges to have this material placed in foreman's locker during afternoon and also arranges for placing in same locker any special material required for jobs on next day's orders.

At that time it developed that each district had its own standards of equipment, its own standards of material and its own standard methods. Conditions were so radically different in these three districts that it was difficult to transfer either material, individual men or crews from one district to another. A program of construction was therefore started.

The standardization of service construction details made it necessary to standardize all other details of line construction. Standard drawings showing all such details have been prepared by the engineering department and index numbers have been assigned to them. Each foreman has a complete set of these prints so that the type of construction desired is indicated by giving the print number. The benefits from uniformity of

TABLE I—LIST OF TOOLS AND RUBBER GOODS CARRIED ON OVERHEAD SERVICE TRUCKS

Quantity	Size	Article	Quantity	Size	Article
1	1¼x8 in.	Digging bar	1	.....	Drill handle
4	100 lb.	Canvas coal bags	1	.....	First aid kit
1	⅞x8 in.	Auger bit	1	8 ft.	Alley arm ladder
2	¾x8 in.	Auger bit	1	36 ft.	Extension ladder (three-piece)
1	⅝x8 in.	Auger bit			
2	½x16 in.	Car bit	1	10 ft.	Butt ladder
1	7/16 in.	Wood bit	1	2½ in.	Solder ladle
1	3/8 in.	Wood bit	1	No. 6786	Flash light
1	.....	Screwdriver bit	1	100 ft.	Tape line
1pair	4 in.	Double-sheave wood blocks	4	.....	Clothespin blanket fasteners
1 pair	3 in.	Double-sheave wood blocks	1	No. 90	Coffee pot
			1	No. 5	Solder pot
1 pair	6 in.	Double-sheave wood blocks	1	4½x10 in.	Leather pouch
			1	No. 1	Burring brace reamer
1	6 in.	Snatch block			
1	8 in.	Ratchet brace	1	.....	Transformer riser
1	12 in.	Ratchet brace	1	⅝x11 in.	Steel ramrod
			250 ft.	¾ in.	Manila rope
1	No. 5	Stencil brush	200 ft.	½ in.	Manila rope
3	No. 6	Sash brushes	150 ft.	⅝ in.	Manile rope
1	2 gal.	Safety can	50 ft.	1 in.	Manila rope
1	No. 2	Framing chisel	1	16 in.	Hand saw
1	8 in.	Cold chisel	1	26 in.	Hand saw
4	.....	Miners' cups	1	.....	Hack saw
4	No. 1604-20	Haven clamps	1	Large	Furnace shield
1	No. 2	Bolt cutters	1	No. 2	Shovel
1	¾R ¼x1½ in.	Pipe die	1	No. 1	Reed-pipe stock
6	¼x4 in.	Star drills	1	.....	Sharpening stone
1	.....	Short bull-point drill	1 set	3 in.	Brass stencils, A-Z
			1 set	3 in.	Brass stencils, 0-9
2	½ in.	Bolt expanders	1	.....	Pipe vise
1	7 in.	Auger bit file	2	No. 3109-10	Lag wrenches
1	12 in.	Bastard flat file	2	14 in.	Stillson wrenches
2	.....	Gasoline furnaces	2 pair	.....	Westcott wrenches
1	No. 02	Funnel	1 pair	No. 260	Rubber knee boots
1 pair	.....	Safety goggles	3 pair	No. 264	Rubber sporting length boots
2 pair	.....	Horsehide over gloves	2	.....	Rubber blankets
1	10 lb.	Sledge hammer	1	.....	Brown motor coat
1	3½ lb.	Double-faced hammer	3	.....	Lineman's rubber coats
1	.....	Bull-point handle	2 pair	.....	Rubber gloves
1	No. 21	Aluminum holder	4½ in. x 3 ft.		Rubber hose

design and construction are now making themselves evident in reduced costs. Briefly, that is the history of the development. Perhaps it would be well also to discuss more in detail the nine principal causes for the reduction in cost.

VERY FEW RUSH ORDERS NOW

The matter of eliminating rush orders was simply handled by a general company order which made it impossible for any clerk who wanted to rush a job to mark "Rush" across the ticket in red letters. The authority for issuing rush orders has now been limited to the general contract agent and to a very few other officials in the company. Eliminating rush orders, of course, has been generally beneficial, since the handling of any jobs outside of the regular routine always tended to slow up work in general. The following formula has been evolved for determining how many days it will take to install a service:

2 X (days required to do job with one gang) + 2.

The natural result of the working of this formula is that it is now possible to schedule services. More than 80 per cent of the services are installed within three

days of the time when the order reaches the street department. The majority of those which do not come within the 80 per cent are services in outlying districts to which it is impracticable to send a crew of men until sufficient work has accumulated to occupy them for at least one-half day, or services which have been delayed by bad weather.

An important part of this scheduling of services and an interesting part has to do with the routing and handling of the men in the field. For the purpose of handling this work the street department divides the city into the Northern, Western and Southern districts, each of which has a separate office. At each of these offices a work dispatcher is stationed who receives the orders for services and who can then locate them on a map of the city by means of specially colored loca-

TABLE II—STANDARD STOCK OF MATERIAL FOR SERVICE TRUCKS

Quantity	Item	Quantity	Item
2	Four-pin alley arms	16	50-amp. fuses
3	Six-pin alley arms	3	Ground rods
5	Six-pin cross-arms	6	Ground-rod caps
1	Eight-pin cross-arms	8	Ground-rod rivets
1	Eight-pin transformer arm	4	Guy clamps
1	42-in. transformer arm	4	Guy plates, S print No. 371
10	⅝x12 in. through bolts	4	Guy plates, S print No. 372
10	⅝x14 in. through bolts	12	½-in. strain balls
6	⅝x16 in. through bolts	6	⅝-in. strain balls
4	⅝x18 in. through bolts	18	Porcelain primary insulators
2	⅝x20 in. through bolts	36	D.G.D.P. glass secondary insulators
2	⅝x22 in. through bolts		
1	⅝x24 in. through bolts	24	Transposition insulators
10	⅝x16 in. double-arm bolts	2 gal.	Kerosene
10	⅝x18 in. double-arm bolts	100 ft.	1-in. molding
6	⅝x20 in. double-arm bolts	20 ft.	1½-in. molding
4	⅝x22 in. double-arm bolts	3 lb.	Tenpenny nails
2	⅝x24 in. double-arm bolts	5 cans	Soldering paste
75	½x2½ in. lag bolts	½ gal.	P. & B. paint
25	½x4 in. lag bolts	1 lb.	White lead
25	½x2½ in. carriage bolts	8	Locust pins
6	½x5½ in. eye bolts	6	Steel pins
24	⅝x4 in. machine bolts	15	Pole steps
4	½x1½ in. machine bolts	10 lb.	Salt
18	½x4½ in. machine bolts	2 gross	Sorted screws
6	½x5 in. machine bolts	8 lb	Bar solder
60	½x1½ in. expansion bolts	75	2-in. staples, three sizes
18	½x2½ in. expansion bolts	100	3-in. staples
1	7-ft. alley arm brace	5 lb.	Friction tape
2	5-ft. alley arm brace	1 lb.	Rubber tape
3	30½-in. knee braces	3 lb.	½-in. round washers
24	24-in. cross-arm braces	2 lb.	⅝-in. round washers
6	24-in. alley side-arm braces	10 lb.	2x2 in. square washers
2	48-in. vertical braces	8	Thimbles for ½-in. guy wire
9	Two-point brackets	6	Thimbles for ⅝-in. guy wire
9	Three-point brackets	600 ft.	½-in. guy wire
1	Two-point special bracket	150 ft.	⅝-in. guy wire
1	Three-point special bracket	1 coil	No. 6 weatherproof wire
4	25-amp. cutouts	1 coil	No. 8 weatherproof wire
2	50-amp. cutouts	50 lb.	No. 4 weatherproof wire
8	⅝-in. eyelets	30 lb.	No. 2 weatherproof wire
24	25-amp. fuses	10 lb.	No. 0 weatherproof wire

tion tacks. When all of the services for a given day are posted the work dispatcher lays out the route for his several gangs by running various colored strings around the tacks in such a manner that each crew will start work at a point farthest from headquarters and so will work back toward the headquarters as it progresses from job to job during the day. The men, instead of reporting at the company's district quarters in the morning, report at the location for the first job and hence lose no time in traveling to their work. The foreman, on calling up by telephone, is notified late in the afternoon of each day of the location of the first job for the following day and informs his men accordingly. The driver, by consulting a chart with which he is provided, can readily determine the time at which he must leave the district headquarters in order to arrive on the job on time. He must get to the barn sufficiently in advance of that time to permit of loading on his wagon the material which has been placed in his locker the previous afternoon. The linemen work eight and one-half hours, and the driver, who is also a groundman, works eight and one-half hours plus the time it takes him to drive the wagon from headquarters to

Mr. E. E. Schermerhorn, General Foreman, District #1. Date April 16th, 1920.

Summary of Average Costs Week Ending April 10th, 1920.

Foreman	Cost of gang per hour	Number of Services Daily and Average Cost. Mon.		Tues.		Wed.		Thurs.		Fri.		Sat.		Total	
Jones	$3.21	1	1.51	12	1.21	13	1.45	1	1.50	7	1.72	4	1.99	38	1.49
Johnson	3.01	4	1.50	3	2.00	7	2.15		-	11	1.50	3	2.00	28	1.77
Brown	3.06		-	13	1.50	15	1.55	9	1.52	1	1.37	7	1.97	45	1.59
Smith	3.11	3	1.04	13	1.55		-		-	7	1.33	1	3.10	24	1.49
Perkins	3.47	3	2.34	10	1.20	15	1.59	2	1.80	8	1.71	8	1.48	40	1.54
Totals	3.17	11	1.60	51	1.41	50	1.68	12	1.56	28	1.53	23	1.86	175	1.57

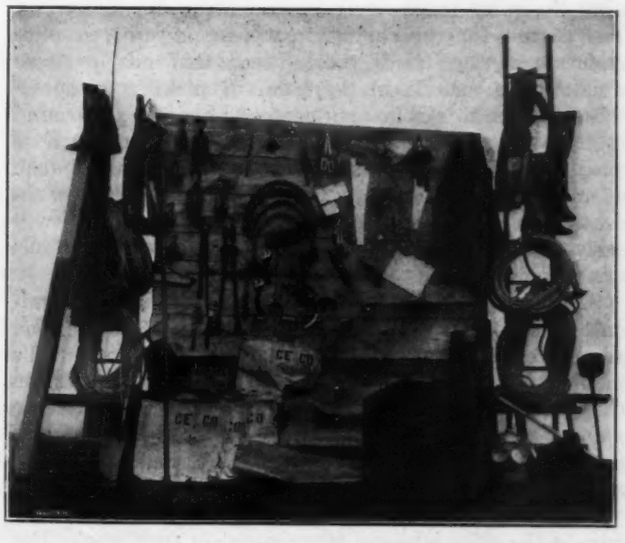
Lowest District Standing: No. of Services 227 ; Average Cost 1.47

WEEKLY SUMMARY OF AVERAGE SERVICE COSTS

This summary is made up each week for each district and gives the general foreman the necessary information to enable him to locate and correct any tendency toward higher service installation costs.

the first job and from the last job back to district headquarters at night.

The question of standardizing line equipment was one which was solved in a rather unusual way. When the three districts were consolidated each general foreman felt that his own type of service construction was best. In order to arrive at a company standard the three general foremen were requested to bring their crews and to erect in a lot selected for the purpose services according to the standards which they were then using or which they thought should obtain. Then each man was requested to point out why he thought his type of service was better than that used by the other crews. It developed that the rival claims of the various foremen centered around the type of construction which would permit several services to be run off the insulators without attaching several layers of wire over each other. A compromise solution of the problem was reached by a suggestion that the company adopt as a standard insulator the ordinary glass triple-groove telephone transposition-type insu-



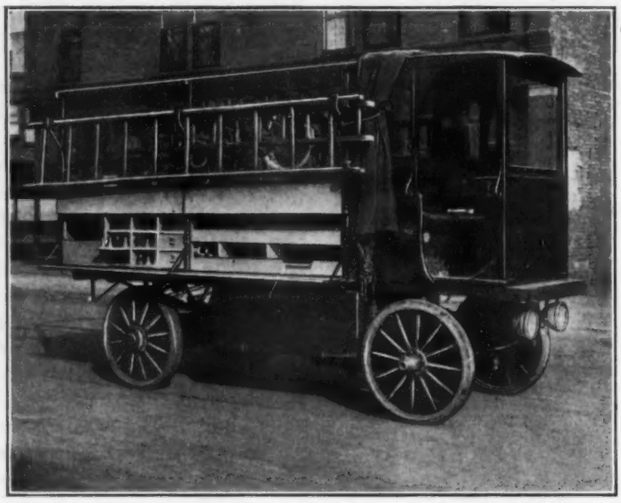
STANDARD STOCK OF WAGON TOOLS AND PROTECTIVE APPLIANCES FOR OVERHEAD SERVICE TRUCKS

In addition to the tools shown on the list and in this photograph, each lineman has his own supply of lineman's tools carried in his belt.

lator. This is now used for all services and makes it possible to run a number of services from any pole without tangling them.

While this insulator incident is only a detail in the standardizing process, it illustrates the methods which have been employed to reach a standard commonly accepted by all supervisory and field employees. The same treatment has been applied to all overhead-line equipment. A more detailed article on the standardization of pole-top equipment was published in the ELECTRICAL WORLD of April 27, 1918, the author of which was H. E. Wulfing.

Improvements in the wagons which haul service crews and their equipments have been worked out on the theory that a compartment should be built for everything in such a way that materials and tools cannot be put in the wrong place, because they will not fit any compartment but the one in which they belong. The wagons are truly a marked departure from the earlier wagons used by line crews, which were famous for the fact that it was usually necessary to "excavate" in the vicinity of the wagon bed when any particular piece of apparatus or any tool was needed.



OVERHEAD SERVICE TRUCK WITH STANDARD STOCK OF TOOLS AND MATERIAL

Lids or doors to the compartments can be fastened with padlocks. Space is provided for safe-keeping of linemen's personal tools over night.

It is an interesting sidelight on the standardization of the stock and tools that the standard stock is 500 lb. (226 kg.) lighter on an average than the stock which was carried in the wagons before standardization was effective. This figure was arrived at by running the wagons over a scale on the day before the standard stocks were placed in them for the first time and running the same trucks over the scale the day following. The reason for the saving in weight is quite easy to understand when it is remembered that nearly every construction man is in the habit of picking up something that he thinks he may need and carrying it around in the wagon for perhaps a year before he really does need it. The list of tools and the standard wagon stock of materials which are reproduced herewith show in detail what the wagon carries, and the photographs will assist the reader by showing how these stocks and tools are placed in the wagons.

Samples of the typewritten order form which eliminates the clerical work formerly required of the foremen are reproduced. On this report blank the foreman fills in absolutely nothing that can be filled in for him in the office. He makes notations which indicate the amount of work done, the time at which each job was begun and the time at which it was finished. He makes no attempt to divide the time among the various kinds of work which he lists. These divisions are made by men in the office who are experienced in such work. For all practical purposes this is just as accurate as if the foreman were to charge each part of each job with the hours and minutes devoted to it, because in the reports to the timekeeper half hour units are used.

The foregoing paragraphs describe briefly the system which makes it possible for the service crews of the street department to operate efficiently. There are, however, a number of other points which deserve special comment. One which certainly should not be forgotten is the personnel of the service crews themselves. The standard service crew consists of four men, including a foreman, a driver who acts as a groundman, a first-class lineman and a second-class lineman. These crews install a typical service and move to one location from another in about twenty-five minutes. They benefit because the system which has been developed for doing the work actually reduces the necessary effort on their part. There is no hurry and no excitement about the way in which the work is tackled. There is no element of "rawhiding." Their efficient operation can be attributed to the elimination of useless work, to doing things the easy way with the proper equipment, all efforts being intelligently directed and thoughtfully applied.

Many "kinks" have become standard practice with the service crew. Several have been worked out in the method of soldering. For instance, the soldering pot has an offset bale so that it can be lifted under line wires easily to catch the solder which is being ladled over the joint. The hook with which this pot is lifted has a corkscrew end, so that it is impossible for the lineman to let the pot fall off the hook even if it is bumped against something. At the end of the service line which is attached to the building pigtail splices are employed because it is easy to get the end of these splices into a ladle full of solder and because it would be difficult to hold the pot of solder in such a position that the molten metal could be ladled over any other kind of a joint in this location.

There are other kinks in handling material and tools. The linemen carry brackets, insulators, hammers, chisels, brick drills, etc., in canvas bags which are of the same type as those used by coal companies for handling coal a bushel at a time. This type of bag was selected because of its rugged strength and because it was not thought advisable to make up a special bag for the lineman to use. Convenient receptacles for carrying soldering acid and paint to use on the outside of taped joints are provided with hooks and arranged so that they can be swung from the belts of the linemen. All these things contribute their quota to efficiency.

THE *engineer is more than ever needed as a guide in national affairs. That man is not wise who does not consult the expert in matters demanding special information not possessed by himself. An engineer should also be an example of a broad-minded citizen, interesting himself in all such activities as conduce to the welfare of his country and its people and the world.* —ELIHU THOMSON.

Protection of Transmission Systems—I

Comprehensive Analysis of Abnormal Voltages on Transmission Systems and Methods Adopted by a Company in Sweden to Protect the Station Apparatus from Insulation Breakdown

By PROF. EMIL ALM

WHILE the nature of overvoltages is far from fully understood, it is certain that their causes may be found in atmospheric discharges as well as disturbances internal to the system, such as switching, grounds, short circuits, etc. The overvoltage phenomena, whether they are due to internal or external causes, appear generally first as traveling waves, but change later into oscillations between the capacity and inductance of the system. In certain cases, especially with overvoltages from internal causes, resonance is liable to be set up, resulting in a considerable increase in the voltage stresses.

In planning the overvoltage protection for the Untra (Sweden) power station, these points have received due consideration and have resulted in the adoption of the system shown in Fig. 1. The principles which led to the selection, rather than a description of the installation, are treated in what follows here.

The Untra power station is designed for five water-wheel-driven generating units, each having a capacity of 7,300 kw. at 0.80 power factor, 6,800 volts, 25 cycles. Four of these units are now installed. The transmission voltage is approximately 100,000 volts, and the generator voltage is transformed up to this value by means of three-phase transformers, each of the same capacity as the generators and thus forming units with these so that the paralleling may be done on the high-tension side. There are for this reason two sets of busbars, which may be considered as part of the transmission lines. A low-tension bus is provided for transfer of a reserve unit and other auxiliary purposes. In the receiving station at Vartan the voltage is transformed down to 6,300-6,000, and the high-voltage arrangements in the two stations are practically identical. A complete system of connections for the entire installation, showing the various protective arrangements adopted, is given in Fig. 1.

Voltages Arising from Atmospheric Disturbances

Gradual Charging.—To provide a discharge path for the gradually accumulated static charges on the transmission line, the transformers at Untra, with their low-tension windings delta-connected, have the high-tension windings star-connected with the neutral point grounded. In order, furthermore, that a ground on the line shall not cause a direct short circuit of the grounded phase, a resistance is inserted in the neutral connection. For the sake of safety it was also considered advisable to make such provisions that a disconnected transformer unit would not be subjected to voltages through its neutral connection in case of a ground. As at Untra no space could be found for a common neutral bus to which the respective transformers could be connected by means of switches, each transformer had to be provided with its own resistance. For taking care of the static charges it is evidently immaterial whether resistances or inductances are used, and their sizes can be varied between very wide limits. For the correct functioning of certain relays the resistances used were, however, so dimensioned that the short-circuit current at normal voltage would be about 10 amp., whether two, three, four or five transformers were in operation. They were made in two parts for 20 and 30 per cent respectively of the full current to ground.

Lightning Charges.—A thunderstorm cloud can, by static induction, charge a grounded transmission circuit

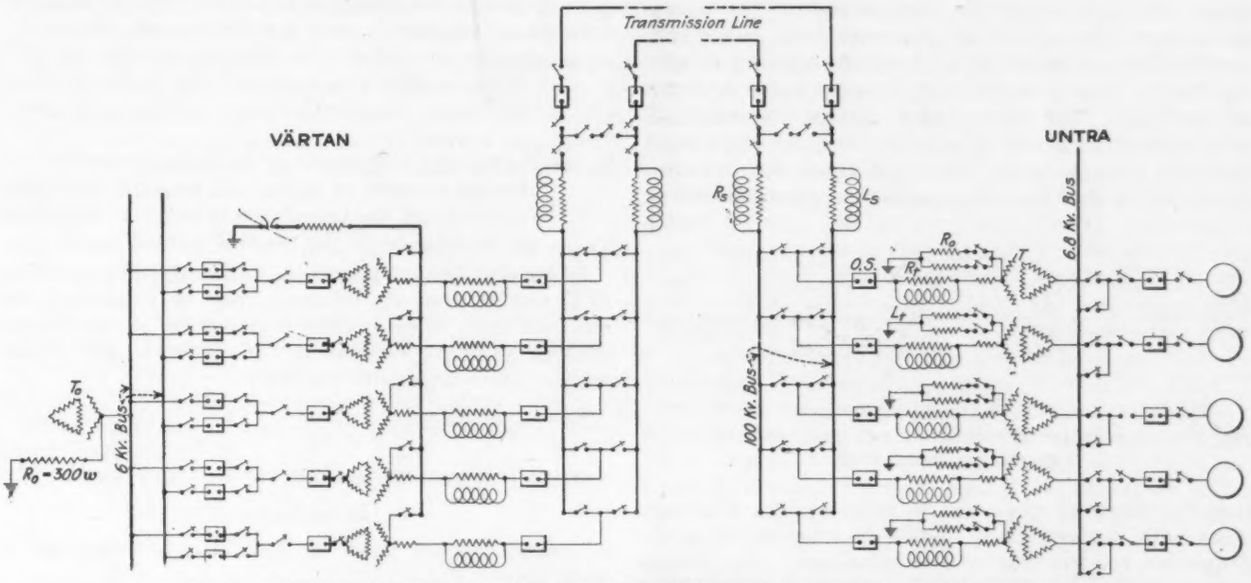


FIG. 1—CONNECTION SCHEME FOR PLANT AND TRANSMISSION SYSTEM AT UNTRA, SWEDEN

Abbreviations: OS = oil circuit breaker; T = transformer; L_t = transformer inductance coil; R_t = shunt resistance for same; L_s = line inductance coil; R_s = shunt resistance for same; R_o = neutral resistance; T_t = transformer neutral resistance. The generating station is connected to Värtan over 100-kw. transmission lines.

with a quantity of electricity which, when the cloud discharges, raises the potential of the circuit to a value which depends on the height of the wires above ground and which may amount to about 20,000 volts for each meter in height above the ground. As the average height of the Untra line is about 10 m., we can therefore expect a voltage rise above normal of about 200,000 volts, which corresponds to an alternating-current sinusoidal voltage with an effective value of 140,000 volts. Adding to this the normal voltage to ground (60,000), we find that the total voltage stress to ground due to a lightning discharge may reach an effective value of 200,000 volts. With one of the phases grounded, the total potential to ground would therefore be about 240,000 effective volts.

After the lightning discharge, the above-mentioned static charge will divide into two equal traveling waves, each of one-half its amplitude, going in opposite directions. On account of the distribution of the charge before the lightning stroke, the wave front has a comparatively small slope and is therefore not very dangerous for the insulation between adjacent turns or layers of windings. The only danger is that its amplitude may cause a puncture to ground. On the other hand, when the charge is set free—that is, at the lightning stroke—if a flash-over occurs on an insulator string,

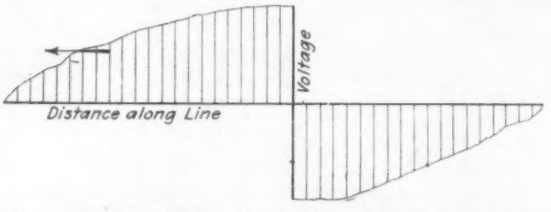


FIG. 2 — VOLTAGE DISTRIBUTION ON THE LINE FOLLOWING AN INSULATOR FLASH-OVER

then the charging wave will be followed by a discharge wave with a steep front, which is considerably more dangerous for the transformer windings. The voltage jump will then be equal to the entire flash-over voltage of the insulator string (Fig. 2). If with such grounds an arc is formed, other difficulties are very liable to occur, such as destroyed insulators, burned-off wires, etc.

To avoid the risks which are connected with an insulator flash-over there are two remedies which can be used: First, the flash-over voltage of the insulator string may be made so high that an induced charge from a lightning stroke is unable to cause a flash-over; second, the statically induced voltage may be limited by means of ground wires. Both of these protective arrangements are used in the Untra installation. The insulator strings have a minimum flash-over voltage value of about 250,000 when wet and somewhat higher when dry, and the ground wire, which is installed above the transmission wires, is expected to reduce the overvoltages about 40 or 50 per cent.

PROTECTION AGAINST GROUNDING PHENOMENA

Experience has shown that even with the best precautions it is impossible absolutely to prevent grounds, which may be caused by blown-down branches of trees, etc. On networks with relatively high currents to grounds it has been proved that such arcing grounds may be quite disastrous if suitable precautions are not taken. If the ground current be of such strength that the arc will not go out but an intermittent grounding takes place, and if there be no suitable ground connection, then the system will be charged between each reformation of the arc to a constant potential with a value up to two and a half or three times the maximum value of the normal voltage to neutral and with alternating positive and negative signs. Partly on account of this rise in the voltage to ground, but chiefly on account of the high value of the voltage impacts to which the transformer windings are hereby exposed, it becomes necessary to make arrangements which will prevent these dangerous phenomena from occurring. The most effective method is to provide for a discharge of these voltages before they have been able to do any damage, and this was done by a suitable dimensioning of the neutral resistances of the Untra transformers. Either non-inductive resistances or inductances may be used for grounding.

CALCULATION OF NEUTRAL GROUNDING RESISTANCE

In this case we obtain a discharge with C in series with an inductance L_k over a resistance R_o, where:

C = capacity of all of the lines to ground = $3K''$ for a single line and $6K''$ for a double line, K'' being the partial capacity for each phase to ground.

L_k = the leakage inductance of the transformer divided by the number of phases, if, as with the Untra installation, the transformers are Δ-Y connected.

R_o = the resistance in the neutral ground connection.

In general, the inductance L_k is so small in proportion to C and R_o that its influence may be neglected, and we then only have a condenser which is discharged through an ohmic resistance. The potential diminishes then in accordance with the law:

$$v = Ve^{-\frac{t}{R_oC}}$$

Besides the wattless ground current through the air,

$$I_j = E_f\omega C,$$

an energy current flows through the resistance and is equal to:

$$I_r = E_f/R_o,$$

where E_f = the effective value of the voltage (to neutral).

Both these currents will now pass through the arcing ground, so that the current of the arc becomes:

$$I_b = \sqrt{I_j^2 + I_r^2}$$

With a too high value of R_o the result will be that V will not have time to fall off sufficiently before the voltage of the faulty phase again causes a flash-over. If R_o is made too small, the discharge will be good, but the total current I_l will be more than necessarily higher than I_j, thereby decreasing the ability of the arc to extinguish itself. It seems to be most satisfactory to dimension R_o so that, approximately,

$$I_r = 40 \text{ to } 100 \text{ per cent of } I_f$$

or that

$$R_0 = (2.5 \text{ to } 1)\,\frac{1}{\omega C} \text{ ohm.}$$

For the Untra installation calculations give $K'' = 0.656$ m.f. For a single line we thus get $C = 1.97$ m.f., and for both lines $C = 3.94$ m.f. According to the above formula, the value of R_o will thus be:

For single line:	R_o = 8,000 to 3,200 ohms.
For both lines	R_o = 4,000 to 1,600 ohms.

As already mentioned, the neutral resistance was proportioned for 10 amp. and has thus a resistance of 5,600 ohms, which may be considered as satisfactorily meeting the requirements connected with the discharge problem, especially as besides this the automatic overload circuit breakers will be set so that the faulty line can quickly be disconnected.

CONSIDERATIONS CONCERNING THE USE OF INDUCTANCE IN NEUTRAL

By using a non-inductive ground resistance, as explained above, the danger of the excess voltages due to grounds is removed, but when the current to ground is of a sufficiently high value the arc will continue to burn and thereby cause damage to insulator strings, the burning off of wires, etc. If, on the other hand, an inductance is used, then the charging current of the line will still be vectorially combined with the ground current through the inductance in order to give the resulting current in the arcing ground. As now the two components are opposing each other, the arc current will be equal to the arithmetic difference between the two components, and if they are of equal value, then the arc current will be zero; that is, the arc cannot exist but will immediately be extinguished. The condition for this is therefore:

$$I_f = I_l \text{ or } E_f \omega C = E_f / \omega L_o,$$

and

$$\omega^2 L_o C = 1.$$

The inductance of the neutral ground must therefore (at the frequency of the system) be in resonance with the sum of the partial capacities of the system to ground. With the previously given values for C, the reactance ωL_o with both lines connected should therefore be:

$$X_o = \omega L_o = 1{,}600 \text{ ohms.}$$

With $E_f = 56{,}000$ volts, we get

$$I_l = 35 \text{ amp.}$$

In order that the circuit-breaker relays shall operate satisfactorily, the current in the grounded phase must not drop to zero, and as experience has demonstrated that the arc will go out even when the current in it is from 5 amp. to 6 amp., it was decided that the current through the inductance of the neutral ground could be about 30 amp.

The discharge of the constant potential caused by the first breaking of the arc takes place through a dampened sinusoidal oscillation down to zero, and if the coil were dimensioned for the entire normal arc current, then this oscillation would have the same frequency as the system. In the case here noted, with a somewhat higher inductance, the frequency of the oscillation will be somewhat lower than the frequency of the system. From this it follows directly that the voltage of the faulty phase will rise according to the same law as the discharge just mentioned, or ordinarily so slowly that an arc will not be formed unless the insulation is so weakened that it cannot withstand the normal voltage, in which case the line in question must be disconnected.

Inductances give, without doubt, a more satisfactory solution of the protective arrangements against the disturbances caused by grounds than non-inductive resistances. With both arrangements it is possible to prevent the traveling waves with abnormally steep fronts caused by oscillatory grounds. The inductances, however, have the added advantage that the current flowing through the temporary ground will not cause any arcing. If the cause of the disturbance is removed, then the line will be immediately operative and need not be disconnected. With a non-inductive resistance for about 10 amp., the current through the fault with one line will be about 20 amp. and with both lines about 40 amp., and it is very doubtful if even at the lower current the arc will go out. In such a case it would be necessary immediately to disconnect the faulty line, even if the fault were only transient.

WHY RESISTANCE WAS USED IN NEUTRAL

On the other hand, one must always be prepared for grounds of a permanent nature, and arrangements must naturally in any case be made so that the line can be disconnected if necessary. If this switching arrangement is automatic, as planned for the Untra installation, then this will, of course, somewhat diminish the advantages of the inductance neutral grounds. There are furthermore other overvoltages which will be dealt with later for which the non-inductive resistance has a decided advantage over the inductance. Finally, all the insulator strings are equipped with a kind of horn, primarily intended for improving the potential distribution of the insulators, but also useful as a spark gap, whereby an eventual arc is carried away from the line wire and the insulator. What kind of operating disturbances it would be especially desirous to guard against could not be decided beforehand. It would undoubtedly be safest to make all the permanent ground connections non-inductive and, in addition, as a protection against traveling waves treated later on, install non-inductive resistances in series with spark gaps, the gap being set for somewhat higher potential than the line to neutral voltage. As yet it may be assumed that non-inductive neutral ground resistances give a more varied means for protecting against operating disturbances than inductances, the result being that the resistances were used in the case in question.

PROVISION AGAINST VOLTAGE RISE CAUSED BY GROUNDS AND SWITCHING

As it can always be assumed that the line is at least partly loaded and as it is rather improbable that a disturbance will occur simultaneously on the same phase of both lines, we need not expect that any voltage rise will occur with values as high as four times normal. The transformer and lines are nevertheless insulated for such a voltage rise, and as a further protection we have the non-inductive neutral ground resistances at Untra. Besides this there is provided at Vartan a non-inductive resistance for 5 amp. at normal phase voltage. This resistance is through a spark gap connected between the neutral transformer bus and ground. Primarily this resistance is intended as a protection against traveling waves. When a ground occurs the former resistances will immediately act as a load, and if the normal phase voltage is exceeded, then the spark gap at Vartan will arc over and thus still another non-inductive load is caused, which prevents the neutral voltage rise from developing any further.

In an early issue this discussion will be completed by the consideration of traveling waves, generator voltage harmonics and the passage of overvoltages into the low-tension system.

This paper was translated and condensed by Eric Lof from a lecture delivered by Professor Alm before the Electro-Technical Society in Stockholm, Sweden.

Regulating Hydro-Electric Prime Movers

Ability to Hold Constant Speed, Inherent Regulation and Momentary Changes of Speed Are Discussed in Detail—Conditions Upon Which Speed Changes Are Based

By C. F. MOSHER
Superintendent of Power Plants Turners Falls (Mass.) Power & Electric Company

THE problem of speed regulation with waterwheel-driven generator sets is inherently more difficult of solution than is the same problem for steam-turbine-driven sets. This is due to two fundamental reasons that follow:

First—The inertia of the rotating parts (or flywheel effect) for the waterwheel-driven machine is usually much less than for the steam-turbine-driven outfit, and a large flywheel effect per unit of capacity is always helpful toward better speed control. A modern single-runner waterwheel-driven generator set of 7,500-kw. capacity, running at 100 r.p.m., with an operating head of 60 ft. (18 m.), will have a flywheel effect of approximately 11,000,000 ft.-lb. per second (1,518,000 kg.-m.), whereas a steam-turbine unit of the same capacity operating at 1,800 r.p.m. will have a flywheel effect of about 60,000,000 ft.-lb. (8,280,000 kg.-m.) per second.

Second—The very "nature of the beasts and the stuff they feed on," the weights of feed, size of inlets, passages involved, etc., render the problem much more complex in the case of the waterwheel.

Why Speed Regulation of Hydro Units Is Difficult

Consider again a 7,500-kw. waterwheel-driven set operating at 100 r.p.m. under a 60-ft. (18-m.) head. Such a machine will have a supply pipe or penstock of about 380 sq.ft. (55 sq.m.) section and will pass at full load about 117,500 lb. (53,200 kg.) of water per second—a heavy, inelastic, practically incompressible fluid in usually quite a long column, which may not be started, stopped or have its velocity changed too abruptly with impunity, no matter what may be the load requirements. On the other hand, a steam turbine of 7,500 kw. rating, running at 1,800 r.p.m. at 250 lb. (17.5 kg.) pressure, with 150 deg. superheat at the throttle, will be supplied through a 10-in. or 12-in. (25-cm. or 30-cm.) diameter pipe having a cross-sectional area of perhaps 0.75 sq.ft. (0.069 sq.m..), or 0.002 of that required for the waterwheel set. It will pass approximately 27 lb. (12.2 kg.) per second of steam—a light, highly elastic medium whose flow may be started, stopped or have its velocity changed as rapidly as may be desired to accomplish a given result, without any distress to equipment. This weight passed by the steam turbine is about 0.00023 of the weight passed by the waterwheel. The foregoing is a crude endeavor to explain simply some of the differences in the problems of speed regulation for the two types of prime movers, and perhaps will account for the more complicated speed-control devices usually present in the hydro-electric installation.

There are three main points to have clearly in mind when discussing speed-regulating devices, as follows:

(1) Ability to hold a constant, predetermined or normal speed at no load or at any constant unchanging load.

(2) Inherent regulation, usually expressed in terms of percentage of normal speed, and meaning the drop in speed from no-load to full-load conditions without manual adjustment. As a rule a prime mover can be arranged with a relay-type governor so as to have the same speed at full load as at no load without manual adjustment, but such a condition usually, and in the case of two prime movers operating alternators in parallel, would most certainly result in a condition of unstable equilibrium; so it is the usual practice to adjust all governors for an inherent regulation of from 2 to 3 per cent. Few regulate more closely and a great many not so closely.

(3) Momentary changes of speed due to changes of lead, occurring either gradually or suddenly, usually expressed in percentage of normal speed for a certain percentage of load change on or off, and the time required, in seconds, for restoration of normal speed at the new load.

A modern well-designed and constructed hydro-electric installation may be and frequently is installed so that it will satisfy the first two points above quite as well as any steam-turbine installation; but to satisfy the third point as well is a practical impossibility and always will be, because the designer is confronted by unchanging natural laws.

To operate the gates of the 7,500-kw. waterwheel above mentioned requires for full stroke in one second 125,000 ft.-lb. (17,250 kg.-m.) of energy, or approximately 230 hp. It is entirely feasible to construct speed gates and operating mechanism to close them much faster than this, but it is entirely impracticable to construct penstocks of the required dimensions to withstand the resultant shocks without rupture.

Tests for Rapid Load Change

A test has been made on a 7,500-kw. machine of a type and under conditions similar to the one referred to, in which full load was thrown off and the gates closed in just over two seconds, and yet there was a momentary pressure rise in the wheel case of about 78 per cent. The momentary rise in speed on this test was from 18 to 20 per cent. This same machine shows on test an inherent speed regulation of 3 per cent. The test for inherent regulation was made under low-head conditions, and it is probable that at normal head the regulation would be reduced to about 2.5 per cent. It is a point easily controlled by adjustment, if necessary.

On these units the governors are guaranteed to work in parallel with each other and with other governors on the system being so arranged that the drop in speed from no load to full load may be adjusted from zero to 3 per cent. When properly adjusted the governors maintain approximately equal load on all generators. Each governor is designed to be sensitive within 0.25 per cent; *i.e.*, for a change in speed of 0.25 per cent the governor will immediately move the gates, and for slow changes of load will keep the speed within 0.25 per cent of normal. Each governor is provided with adjustment to allow of complete gate movement within one second, provided such fast operation becomes desirable.

The governors are guaranteed to control the speed of the main units in accordance with the following percentage table of speeds and load changes:

Load Changes	Speed Change On	Speed Change Off
5	1.10	1.0%
10	2.10	1.8
25	5.50	4.5
50	10.00	8.5
100	18.00	16.5

The maximum rise in head measured one-half way around the scroll is guaranteed not to exceed 50 ft. (15 m.) when full load is instantly thrown off the generator at normal speed and head.

Conditions.—The above speed changes are based on the following conditions:

(1) Normal effective head on waterwheel, 60 ft. (18 m.); normal speed, 100 r.p.m.

(2) The WR^2 of the combined unit to be not less than 7,000,000 ft.-lb.

(3) The concrete penstock from headgates to center line of the unit not to exceed 90 ft. (27 m.) in length and to be not less than 380 sq.ft. (34.9 sq.m.) in section up to the scroll case.

(4) Length and shape of draft tube in accordance with specified design, the design of the entire setting including penstock and scroll case being subject to governor builder's approval.

One other risk involved in a too quickly closing gate mechanism is the possibility in an installation with a long draft tube of having the column of tailwater suddenly part company with the wheel and a little later surge back with a tremendous blow and wreck it.

In general, the nearer an installation approaches that of an open flume setting without draft tube the more quickly may the gates be safely operated; but such a type of setting is cumbersome, expensive and for most developments inefficient and inadvisable, so that speed regulation for sudden load changes in most installations is made as fast as the hydraulic conditions will allow.

It is often necessary in connection with long penstocks to install surge tanks to relieve shocks due to quick gate movements, and sometimes relief valves are also provided. In high-head plants using the Pelton type of wheel it is usually the practice to divert the nozzle from the wheel as a means of speed and power control, rather than to stop the flow of water.

Waterwheel governor design has settled down to one rather generally accepted type known as the "hydraulic relay compensated type," using a flyball governor, either belted or mechanically connected to the waterwheel shaft as a primary control and through a pilot valve, with restoring and compensating mechanism, and a relay valve controlling the flow of a fluid under pressure to one or more servo-motor cylinders that are suitably connected to and operate the speed gates through a combination of links and levers. The operating fluid has usually been a mineral oil, and in earlier designs each governor had its own individual pump, pressure tank and vacuum tank. The pump was continuously discharging oil into the pressure tank, which was partially filled with air to give elasticity and quick action, and the servo-motor cylinders discharged into the so-called vacuum tank, whence the oil was picked up as it came over by the pump. This was a closed system and was comparatively simple, but the oil was expensive, short-lived and gave off considerable carbon deposit.

In the last few years this system has been improved upon by substituting a discharge tank under atmospheric pressure for the vacuum tank and installing a pressure-operated unloading or by-pass device on the pump. In multiple installations a central pumping system has been installed, the pumps being motor-driven with automatic pressure-controlled starting and stopping devices. Both of these arrangements represent an improvement, and, owing to the relief of the oil, which is somewhat warm from the vaporizing effects of the low pressure in the vacuum tank, the oil appears to have a much longer life than previously and a reduced carbon deposit. In recent years and in larger installations it has become quite common practice to use water under pressure as the operating fluid, introducing 1.5 to 3 per cent of soluble oil. The function of the oil is primarily to prevent corrosion of the working parts of the system with which it comes in contact. This has in most cases worked out very well.

The foregoing is abstracted from a paper read before the System Operators of New England, Worcester meeting.

Writing Specifications for Lubricating Oils and Greases

General Properties of Oils Which Have a Bearing on Specifications—Typical Specifications for Turbine, Dynamo and Other Oils

BY A. A. POTTER* AND A. J. MACK†

IN WRITING a specification it should be the object to insure a satisfactory product, but in the case of lubricants the specification must be so worded that it will apply not only to oils from the Pennsylvania fields but also to those from the mid-continent and the Southwestern fields. In special cases specifications applying to one particular field are justified, but for most purposes a suitable oil can be manufactured from crude products with asphalt as well as with paraffine bases.

Lubricants may be classified, as to their use, into steam cylinder oils, engine or machine oils, automobile oils, truck and tractor oils, turbine oils, air-compressor oils, dynamo oils, ice-machine oils, greases, transmission oils, lubricants for gears, chains and wire ropes.

Important properties to the user of lubricating oils are those pertaining to viscosity, pour test, flash point, carbon residue, emulsion, freedom from soap, tar, rosin, moisture, acid, alkali, suspended matter or animal oils. The specific gravity is not included in the specifications as it is of value only in determining the source of oil. The crude oils coming from different localities differ as to their specific gravities, but the specific gravity is not an indication of the quality or of the suitability of the oil for a given purpose.

"Viscosity" indicates the fluidity of an oil and refers to the time required for a definite volume of the oil to flow, under an arbitrary head through a standard orifice at constant temperature. The viscosity of an oil is of prime importance in a specification, but should be taken as nearly as possible at the working temperature of the engine or machine. As these temperatures vary greatly, viscosities are usually given in seconds at 100 deg. Fahr. and 210 deg. Fahr. Viscosities refer to the Saybolt standard universal vis-

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cosimeter. The "pour test," often also referred to as the "cold or chill test," is the lowest temperature at which the oil will pour. This property is particularly important in connection with oils which must be operated in an atmosphere of low temperature. The "flash point" is the lowest temperature at which the oil forms an inflammable vapor. The temperature at which the body of the oil catches fire is known as the fire point. Flash-point tests refer to the Cleveland open cup. The "carbon residue" is that which remains after the complete distillation of an oil. "Emulsion" is the property of an oil which refers to its separation from water. Thus a non-emulsifying oil when mixed with water will clearly separate.

Lubricants for most purposes should be straight mineral oils. Steam cylinder oil for engines operating on wet steam is usually compounded with acidless tallow or with other animal oil to cause the lubricant to adhere better to the cylinder walls when in contact with moisture. No compound should be used in oils intended for engines operating on superheated steam.

The presence of acids in oils indicates improper refining, but acidity is also developed when the oil is in use.

Engine or machine oils are those designed for lubricating bearings of engines and of machinery, but are not to be used for lubricating the internal parts of an engine which come in contact with a gas or a vapor. It is usually not necessary that engine oils withstand great temperature changes. Engine oils for slow-speed machinery should have a higher viscosity than those designed for high-speed machinery. A flash point of 300 deg. or 350 deg. Fahr. is sufficient, and the pour test, except when used in an atmosphere of very low temperatures, can be taken as 35 deg. Fahr. Engine oils should be straight mineral oils, well refined, filtered and non-emulsifying. They should be free from moisture, soap, rosin, acid, alkali, tar and suspended matter. The viscosities for different grades are given in the table.

Turbine oils are designed to lubricate the bearings of steam turbines. Turbines require no internal lubrication. As turbine oils are usually circulated over and over again, it is important that they be non-emulsifying when coming in contact with water. A turbine oil should be a straight mineral oil, filtered and well refined. It should be non-emulsifying and free from acid, alkali, tar and suspended matter. The viscosity of turbine oils at 100 deg. Fahr. should be from 140 to 240 seconds and at 210 deg. Fahr. 38 to 45 seconds. The flash point, minimum, should be 370 deg. Fahr. and the pour test not more than 25 deg. Fahr.

ENGINE OR TURBINE OIL MAY BE USED FOR MOTOR BEARINGS

A good engine or turbine oil should give satisfaction when used for lubricating the bearings of electrical motors and generators. Special dynamo oils are available which should meet the following requirements: A dynamo oil should be a straight mineral oil, well refined, filtered and non-emulsifying. It must be free from soap, acid, alkali, tar and resinous matter. The viscosity at 100 deg. Fahr. should be 140 to 200 seconds, and at 210 deg. Fahr. 38 to 45 seconds. The minimum flash point should be 370 deg. Fahr. and the pour test not higher than 25 deg. Fahr.

A steam-cylinder oil must be suitable to lubricate the walls of the cylinder under operating conditions. Steam engines operating with saturated steam use a mineral oil compounded with tallow in order that the oil when it comes in contact with water shall saponify and adhere to the cylinder walls. The amount of compounding depends upon the quality of the steam used. The drier the steam the less animal compounding should be used. Engines operating with superheated steam should use a straight mineral oil without compounding. The amount of compounding allowed for the various grades is indicated in the table accompanying this article.

Steam-engine cylinder oils must be free from dirt or sediment of any kind after standing, must feed freely through lubricators, and must not show more than $\frac{3}{10}$ per cent of acid when digested with boiling alcohol. The other specifications for three grades of steam-engine cylinder oil are given in the table. The flash point depends upon the temperature of the steam. With saturated steam a flash point of about 450 deg. Fahr. is sufficient. Oils used in connection with superheated steam should have higher flash points, depending upon the temperature of the superheated steam.

Cup grease should be a compound of mineral oils and greases. It should contain sufficient soap to form a semi-solid mass at temperatures below 150 deg. Fahr. It should be smooth, free from lumpy particles, dirt or other foreign matter. It must contain nothing which would tend to corrode or injure bearings and must not be rancid.

SPECIFICATIONS FOR LUBRICANTS

Kind of Oil	Viscosity in Seconds — At 100 Deg. F.	Viscosity in Seconds — At 210 Deg. F.	Flash Point, Deg. F. (Minimum)	Pour Test, Deg. F. (Maximum)	Acidless Tallow — per Cent.
Dynamo oil	140 to 200	38 to 45	370	25	0
Engine oil, high speed	140 to 200	35 to 45	350	35	0
Engine oil, slow speed	180 to 300	40 to 55	350	35	0
Steam cylinder oil, dry steam		135 to 165	450	50	5
Steam cylinder oil, wet steam		120 to 160	450	50	5 to 10
Steam cylinder oil, superheated steam		150 to 250	*	50	0
Transmission gear oil		170 to 215	300	50	0
Turbine oil	140 to 240	38 to 45	70	25	0

* Depends upon steam temperature.

Transmission oil should be suitable for gears of motor vehicles, trucks, tractors, and for other purposes where a heavy gear oil is required. Transmission oil should be a petroleum product, free from vegetable or animal oils, residue or fats of any kind. It should also be free from fillers such as talc, resin, tar or other foreign materials. It should contain nothing to injure or corrode the bearings or other metallic surfaces. Transmission oil should have a viscosity at 210 deg. Fahr. from 170 to 215 seconds, a minimum flash point of 300 deg. Fahr. and a maximum pour test of 50 deg. Fahr.

A lubricant for gears, chains and wire ropes should be a petroleum product, free from vegetable or animal oils, residues or fats of any kind. It must not contain fillers such as talc, rosin, tar or other materials foreign to the original product. When applied to a plate of polished steel, the lubricant must protect the steel against the action of chemical vapors, salt or fresh water and against water containing 10 per cent of sulphuric acid. The lubricant when applied to a wire rope should not peel, crack or chip the rope after exposure to weather for a period of sixty days, as a minimum requirement.

HOW SHALL LINES SERVING SUCH TERRITORIES AS THIS BE FINANCED?

Managing Electric Service for Farmers

Experience Which Has Come from Six Years of Business Management of Rural Customers Is Reviewed, and Practical Solutions of Common Contractual and Engineering Problems Are Suggested—Twenty-two Points in Operation

By A. W. JONES
Secretary-Manager Peterson (Iowa) Power & Milling Company

IN 1913 the first transmission line of the Peterson (Iowa) Power & Milling Company was built to connect up a town 10 miles (16 km.) distant. On this line the company first tried out a plan for supplying farmers with electric service. Six farm customers were connected to this line and were taken under contracts very much the same except for price as the company's contracts for today. This would seem to indicate that if the company's farm policy is faulty we have failed to find it out in six years of practice, during which time we have built transmission lines to serve fourteen towns and on these and other farm lines in four counties we have hundreds of farm customers.

From knowledge of general farm conditions throughout Iowa and our experience in giving electric service to the farmers for six years, I know that they can well afford such installations as are necessary to make available central-station service, and the cost of the service after the installation is made is not burdensome. The added improvement and convenience meet the general requirements for more economical operation and better conditions on the farm. After a few months' experience with electricity for light and power it is considered a necessity and is highly recommended by almost every patron. Electric service for the farmer is a mutual business, and any inequitable arrangement either in the rates for service or the regulations imposed by the central station for the installation or the use of equipment will not work out to the advantage of either the producer or the customer.

A reasonably high minimum charge is necessary where farm customers are metered individually on the low side of the transformer. This regulation is necessary to offset line and transformer losses, and it obligates the consumer to use a liberal amount of energy. In justice to the consumer the kilowatt-hour rate must be low enough to make it practicable for him to use a good share of this service for power. These two conditions must be met if the company and the customer are to be satisfied.

If the representative of the power company negotiating for farm-line extensions bears a good business reputation, it is easy to get the farmer to sign a contract detrimental to his own interest, as the subject of electricity is decidedly foreign to him. He commonly admits that he knows nothing about it and is leaving the whole matter to the company. This is all the more reason why the power company, in building business for the future, should be extremely careful in making long-term contracts.

On our main transmission lines we charge a stipulated price for connection on the line, and the farmer pays for all the equipment leading from the transmission line, which is owned and maintained by the farmers. The meters are owned jointly by the power company and the farmer. Our reason for this is that the meters are read infrequently, and in case a meter becomes inaccurate it is much easier to reach an equitable settlement when the equipment belongs to both parties and the blame for not taking proper care of the equipment cannot be placed wholly upon either party.

We limit farm installations to 5-kva. transformers on the theory that all of the continuous power required on a farm can be done with a 5-hp. motor. Such work as

running a large corn sheller, shredding corn, filling silos or threshing grain requires the use of a motor for such a few hours in a year that the farmer is not warranted in making the costly installation and buying a high-priced motor for these few days' work, nor can the power company afford to take the losses in order to sell this additional energy, which, compared to a year's business, is small.

I am convinced that a low minimum charge and high-priced energy is ruinous business. In almost every case it is very unsatisfactory to both the producer and the consumer. The power company, while getting a high rate for energy, sells such a small amount that the percentage of loss is high enough to make the net receipts for such service entirely too low. At the same time the farmer cannot afford to use the service for anything but lighting and fractional-horsepower motors, and he too is dissatisfied because his ordinary power requirements are not taken care of, as he had anticipated they would be.

Approximately two-thirds of the energy used by the farm customers is for day load. Every farmer who is enterprising enough to make an electric installation has plenty of work that can be done profitably by electricity. Obligate the customer under the minimum charge to install motors in order to use up his allowance under the minimum charge and he will soon use much in excess of this fixed amount, which makes it possible to give a comparatively low rate.

ANSWERS TO PRACTICAL QUESTIONS

In making proposals to farmers who contemplate building a new line a number of practical questions must be taken into consideration. Briefly, our experience has been as follows:

(1) At present prices a single-phase, 2,300-volt line with thirty-six 25-ft. (8-m.) poles per mile (1.6 km.) costs about $600. The same line using No. 6 copper, 6,600-volt, will cost $650. A single-phase line operating at 6,600 volts with No. 6 copper on twenty-eight 30-ft. (9-m.) poles per mile costs $675.

(2) We have the farmers sign a joint construction contract, specifying the price per mile for building the line and making the contract binding upon them when enough signers are obtained so that the cost will not exceed an agreed amount, say around $250 to $300 apiece. This allows the power company to carry the extension as far as it can, or cares to, and stop when it wishes.

(3) I prefer No. 6 copper-wire 6,600-volt main lines with No. 8 copper spurs. This voltage is easy to reduce and lightning protection is inexpensive, yet the line will carry a good load, which it will need to do if in a good section of country.

(4) Our terms of payment for line construction are 50 per cent when the contract is signed and the balance when the line is energized.

(5) The construction contract is signed jointly as a copartnership by all the farmers on a proposed line, but the clause limiting the cost to each signer to a specified amount protects each customer and removes the ordinary copartnership objection as to liability.

(6) We own only the main lines. The farmers pay for all the farm lines and turn the mains over to us. It is well to own the main feeders because that gives the central station a good hold on the business.

(7) We supervise and keep up all the farm lines, assuming no responsibility beyond the sections of line we own. We charge the cost of supervision and maintenance of farmers' lines to the various copartnerships, prorate the charge and collect each year from the individual customers.

(8) We assume responsibility for the lines we own only.

(9) The central station must give good service, as a farmer will want some assurance that after he has spent $600 to $800 for an electric installation he will get service that will meet his requirements. He is entitled to this.

(10) Our present contracts for 3-kw. installations are being made at $50 a year for 425 kw.-hr. used within the year and 8 cents per kilowatt-hour for energy in excess of this amount, or $60 for 525 kw.-hr. and 8 cents per kilowatt-hour for excess when a 5-kva. transformer is used.

(11) Most of our contracts run for twenty years.

(12) Customers are obligated to pay for service during the full life of the contract unless this obligation is met by their successors.

(13) We read meters once each year, but they should be checked up two or three times a year.

(14) Customers with a $50 minimum pay $12.50 per quarter in advance, and customers with the $60 minimum pay $15 per quarter in advance; and all pay for energy used in excess of the amount covered by the minimum charge at the end of each year.

(15) Coal clauses I consider a good arrangement, especially if all-steam power is used.

(16) Transformers on which the power company takes the loss should meet its approval; also, all energy-consuming devices should be installed subject to the approval of the power company.

(17) Each customer should own the transformer and substation equipment used for his own service.

(18) We limit transformers to 5 kva. rating, and we find that 95 per cent of our farm installations are 3-kva. transformers. Rightly arranged, a 3-hp. motor will do all the work required on almost any farm.

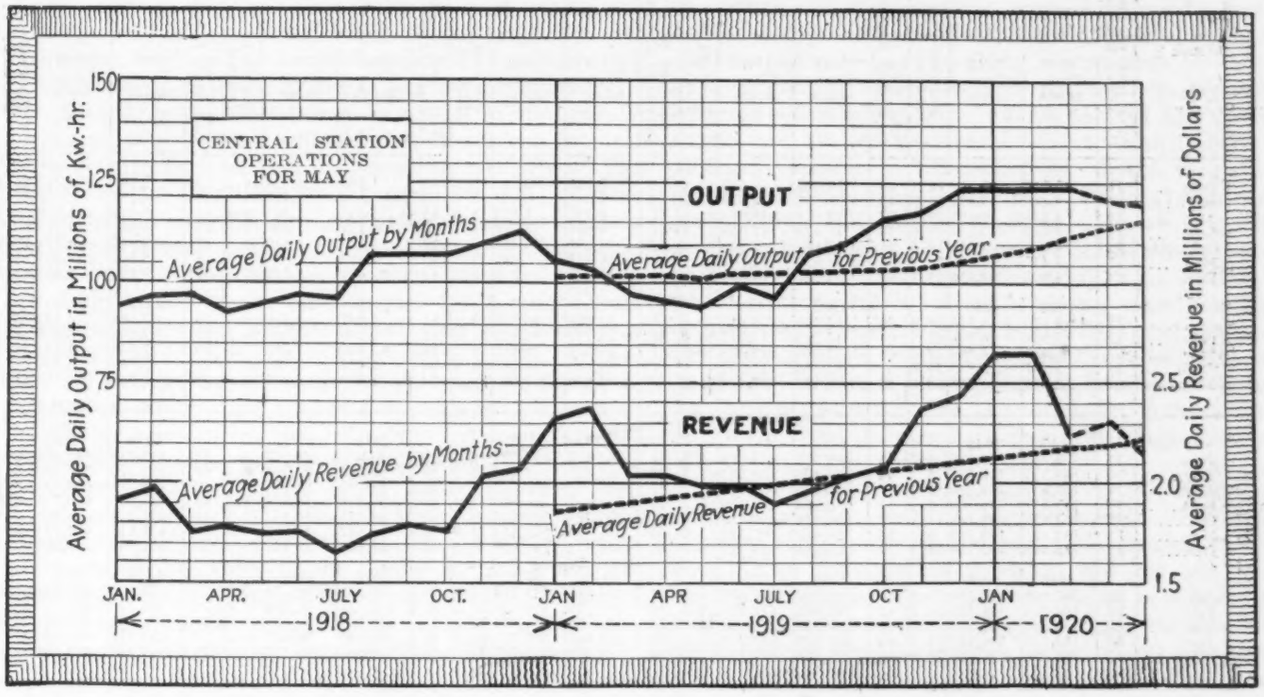
(19) A clause permitting future reasonable additions to the contract affords a good place to provide for something you may overlook.

(20) Keep within your jurisdiction questions of further extensions.

(21) The only farm equipment that gives trouble of any consequence is the transformer fuses. Sometimes during a severe electric storm many fuses on the farm installations will burn out, and with many customers out of service and bad roads this is a source of much trouble. We have overcome this difficulty by the use of a substation equipment of our own design, which, in addition to horn-gap lightning arresters and choke coils, has a removable fused switch blade. Using a 12-ft. (3.6-m.) light-weight weatherproof pole with a special spring finger on the end, the customer can stand on wet ground with safety and remove the switch blade, re-fuse it and replace it in less than five minutes. Since the installation of these fused switches two years ago we have heard nothing from farm customers about fuses. With hundreds of customers this is an important question.

(22) We write liability insurance for our farm customers by an indorsement on our policy, and charge each customer enough to pay this cost. The minimum premium for such an indorsement is $100 per year. The cost to farm customers for this is $1 per year.

Transportation Demoralization Curtails Output



RETURNS received by the ELECTRICAL WORLD for May indicate that with the exception of the Mountain and Pacific States, central station operations throughout the country were the lowest of the present year. Labor troubles and congestion in transportation lines resulted in a wide-spread curtailment in production and a consequent lessened demand for electrical energy. These decreased industrial requirements, in conjunction with the lowered demands for lighting purposes, resulted in a drop of about 2,600,000 kw.-hr. in the average daily output.

The situation in virtually every industrial section of the country appears to have been similar. Diminishing supplies of raw material and the accumulation of finished products due to the thoroughly demoralized railroad situation are reflected very clearly in the central-station returns from the industrial sections, as are also the almost incessant demands of labor.

The labor situation was probably most acute in the New England States, where over 2,000,000 spindles were idle for a portion of the month in one district alone and only a few communities reported no labor troubles. Shortage of raw materials and accumulation of finished products were also reported by every portion of this section. Taken together with the increased demand for lighting purposes, these adverse conditions resulted in a decreased average daily energy demand in New England of about 180,000 kw.-hr. under that of April.

The transportation tie-up continued to dominate the iron and steel industry. At the end of the month pig-iron and crude-steel production was rated at about 50 per cent capacity in the eastern districts and at a much lower percentage in finished steel products. Labor troubles seriously affected the operations of the numerous shipyards along the Delaware River, causing in many cases complete shutdowns. These decreased activities in the Atlantic States during May, augmented by curtailment in production in other lines of industry in that section, are reflected in a 7 per cent drop in energy use under that for April.

A survey covering May shows that shipping facilities in the North Central States were only about 50 per cent of normal. In the Detroit district alone curtailment representing the working capacity of about 50,000 men was found necessary partly because of lack of raw material with which to maintain production. Central-station operations in this section, however, were only slightly decreased for the month as a whole.

The large gains made by the central-station industry in the South Central States during the past twelve months is most strikingly presented by the May returns

TABLE 1—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Capacities Represented	Revenue from the Sale of Energy			Percentage of Installed Capacities Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
June	47	28,175	24,701	14.1	47	1,399,951	1,367,908	2.3
July	44	25,794	22,568	14.1	44	1,309,301	1,281,874	2.0
Aug.	54	32,756	29,006	13.0	54	1,801,836	1,793,706	0.5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.*	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
Apr.†	65	45,017	36,115	24.7	70	2,561,101	2,061,727	24.1
May‡	65	43,494	35,180	23.7	70	2,590,117	2,132,330	21.8

* Includes estimates for ten companies, representing 1.0 per cent of the total installed capacity of all central stations.

† Includes estimates for thirty-six companies, representing 7.7 per cent of the total installed capacity of all central stations.

‡ Includes estimates for forty-three companies, representing 6.8 per cent of the total installed capacity of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	June	71	3,317	2,904	14.1	43	10,605	9,537	12.0	39	7,158	6,166	16.0	40	1,599	1,338	19.5	63	5,496	4,767	15.2
	July	70	3,406	2,995	13.7	40	9,320	8,375	12.0	39	7,240	6,121	18.1	38	1,614	1,321	21.9	49	4,214	3,756	12.1
	Aug	74	4,225	3,693	14.4	57	12,174	10,995	11.1	47	9,295	7,924	15.8	39	1,647	1,385	18.4	61	5,415	5,009	8.5
	Sept	73	4,019	3,536	13.6	53	11,429	10,069	13.5	46	9,671	8,278	16.6	38	1,724	1,488	16.0	63	5,501	4,965	10.9
	Oct	72	4,127	3,453	19.1	53	12,684	10,822	16.9	52	11,401	9,484	20.2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,143	5,741	24.2
	April	82	5,087	3,943	29.0	63	17,138	13,945	22.9	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,150	6,004	19.1
	May	82	4,885	3,750	30.0	63	16,173	13,274	21.8	57	12,499	9,869	26.8	54	2,874	2,139	34.5	79	7,063	6,148	14.7
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	June	71	127,260	119,217	6.7	43	408,335	419,060	−2.5	39	364,552	336,902	8.0	40	53,990	49,520	8.1	63	445,814	443,209	0.5
	July	70	141,551	130,393	8.2	40	373,105	378,053	−1.5	39	371,425	355,664	4.5	38	56,945	52,501	8.1	49	366,275	365,263	0.1
	Aug	74	161,431	153,266	5.1	57	640,616	662,120	−3.2	47	496,745	460,360	8.0	39	58,991	53,231	10.2	61	444,026	464,729	−4.2
	Sept	73	153,837	146,209	4.5	53	610,254	610,179	0.1	46	515,519	463,929	11.5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct	72	162,859	142,326	14.4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov	71	153,171	140,240	9.2	56	724,667	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April	82	187,174	144,922	29.1	64	846,943	673,791	25.8	74	857,467	687,751	22.8	56	135,140	99,877	35.2	79	534,377	455,386	17.5
	May	82	188,210	147,883	28.0	64	813,608	679,173	20.0	74	880,570	710,787	24.0	56	138,534	98,799	40.2	79	569,189	495,688	14.4

from that section. In May 1919 the production of electrical energy in that section was about 3,800,000 kw.-hr. less than that produced in the New England States during the same month. In May of this year, however, central-station operations in the South Central States were 247,300,000 kw.-hr., against 229,300,000 kw.-hr. in New England. The industrial load in this section is increasing very rapidly, which accounts in a large part for this 71.4 per cent increase in energy production in the short period of a year.

Metal production showed a slight increase in the Mountain States over April. Numerous strikes in this section were still under way, and the poor transportation conditions hindered greatly the full operation of smelters and mills. Continued industrial prosperity on the Pacific Coast was sufficient, however, to overcome the sub-normal power demands of the Mountain States, resulting in an aggregate gain for the entire section of about 200,000 kw.-hr. in the average daily consumption over that of April. The stability of the central-station industry in this section is indicated by the fact that at no time during the present year have the monthly operations shown a decrease over the preceding month

Brass Furnace Highly Developed

THE evolution of the electric brass furnace has now proceeded to such a point that fundamental improvements in design are henceforth likely to be rather slow to materialize, according to H. M. St. John. There will, of course, be constant progress in the development of refinements in mechanical and electrical design calculated to make the furnaces more reliable, more durable and more nearly foolproof than they are at present. One of the most fertile fields for such improvement is in the development of refractories more exactly suited to the requirements of electric furnace operation.

Readers' Views and Comments

Improvements Needed in High-Voltage Air-Break Switches

To the Editor of the ELECTRICAL WORLD:

SIR: Air-break switches for the higher voltages, customarily known as horn-gap switches, were originally designed as a commercial product to furnish an economical means of sectionalizing transmission systems and disconnecting customers' substations. They were generally mounted on poles or other suitable structures and controlled from the ground. It was not intended that these switches should break any loads, neither were they to be used at points where the charging current would be excessive. Auxiliary arcing horns were added perhaps as an afterthought in order to protect the main contacts from the burning to which they would undoubtedly be subject under certain conditions.

With the general acceptance of the practicability of outdoor construction other very important uses have been found for horn-gap switches. Owing to the fact that improvements on the switches have not kept pace with improved methods of power transmission, the operating engineer has found himself confronted with a singularly vexatious problem. Outdoor transformer banks and switching stations were heretofore more or less of an experiment. Today, however, outdoor construction is recognized to be both practical and economical. Systems are of larger capacity and extend over considerably greater areas. The operating man

finds by comparison that the same reliance cannot be placed in his line-sectionalizing switches that experience has convinced him he is justified in placing in other line material and equipment. Operating conditions on most systems are such that the horn-gap switches are doing service for which they were originally not intended. Every operating engineer has had this forcibly brought home to him at one time or another.

After this vague criticism it is well to cite specific reasons why present switches are insufficient to meet the requirements of present operating conditions. The most serious handicap to the extensive use of these switches is their lack of rupturing capacity. Nearly all types depend almost entirely upon a modified horn-gap action rather than a positive action of actually pulling the arc up the horns, which is, of course, only possible where the movable contact travels upward in a vertical plane. A defect in the design of some switches is subjecting the operating insulators to torsional or tensional strains that tend to pull the insulator sections apart or loose on the pin. Pin-type insulators are not designed to withstand the heavy torsional or tensional strains. The protection of all operating parts and particularly the main contact against the weather and possibility of freezing is the feature of design which must be carefully worked out. Some of the horizontally operated switches now on the market are well protected against the weather.

Considerable thought has been given to the design of the main contact of the switches, but this study has not as yet, in the writer's opinion, produced a dependable contact. I believe any of the contacts now in use on horn-gap switches would operate successfully under ideal conditions, but it must be remembered that the switches are never used under ideal conditions. They are installed on top of a pole or substation structure and seldom if ever inspected or adjusted. A dependable contact would be one that could be effectively protected against the weather and self-adjusting, so that its carrying capacity would not be reduced by unexpected strains on the switch. The contact should not be one that must be held closed against tension, because such a contact would have a natural tendency to work open.

In redesigning horn-gap switches to meet the present-day operating conditions, serious consideration should be given to the feasibility of making more of the parts interchangeable. Also it should be possible to make replacements of parts quickly. It should be possible to change an insulator almost as quickly as a line insulator can be changed. Owing to the tremendous expansion of transmission systems the energies of the manufacturer have been concentrated upon production rather than on development, but we look forward to air-break switches which will meet our present requirements. Experience suggests that the following features be considered in the design.

The general type of switch is most important. The vertical-break switch has many advantages over a switch of the horizontal-break type, provided the vertical-break switch is so designed that the arc is lifted up the horns just as rapidly as the switch arm is raised in opening. Also the switch should provide a larger gap between the tops of the horns than has been the general practice. This is not only important in breaking heavy energy loads, but it is necessary when breaking low-power-factor loads or charging currents such as sectionalizing switches are called upon to handle. A switch designed in this way would prevent the possibility of an arc from one switch striking the horns of an adjacent switch, thus causing a short circuit.

The switches must, of course, be absolutely weather-proof. The main contacts, as well as all other parts of the switch and the operating mechanism, must be protected against sleet and ice. All of the live iron and steel parts should be galvanized. All bearings should be brass-bushed or babbitted and provided with grease reservoirs for lubrication. In no part of the switch should two iron or steel parts between which there is any motion come in contact. They should be spaced apart with brass rings or plates, so as to prevent any possibility of their rusting together. The main contact of the switch should be protected against the weather by a sleet hood which entirely covers it at all times, whether the switch is opened or closed. It should also be protected against burning by auxiliary arcing horns. The contact should be a self-adjusting type which aligns itself with a contact blade. It must be of such design that unexpected strains on the terminals of the switch or a warping of the structure upon which it is mounted will not cause poor contact or burning.

All torsional or twisting strains on the insulators must be avoided, as such strains would loosen them between sections or on the pin. All strains on the porcelain or between the porcelain and the pin must be in compression. The insulators should be secured to the pins in a manner permitting their easy removal, but the insulators must be securely locked to the pins. All of the insulators on the switch should be interchangeable for any position on the switch; that is, all of the parts which are permanently attached to the insulator should be duplicates, so that a single insulator could be held as a spare for any position on the switch. The insulator pins should be either forged steel or malleable iron. The terminals should be heavy cast brass or copper. The switch must be easy to install and of such design that when adjustments are once made they will remain permanent.

Wheeling Electric Company, FRANK HOWARD,
Wheeling, W. Va. General Superintendent.

The Oersted Centenary

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue for June 19, in an editorial note entitled "A Notable Centennial," you advocate the commemoration of the hundredth anniversary of Oersted's discovery of the phenomenon of electromagnetism. To the name of the celebrated Danish scientist you appropriately join that of the renowned Frenchman Ampère, who at once perfected the discovery made by Oersted. Following the discoveries of Franklin, Volta, Cavendish and a host of others, they opened the way to the wonderful development of modern electricity of which the present age is justly proud.

We view with satisfaction your endeavors to have the importance of Oersted's discovery duly recognized and to procure for permanent record reflections from experience and study bearing upon the influence of the early work of Oersted and Ampère. We shall highly appreciate any contributions to this end as well as any information regarding inventions, from whatever source it may be obtained. We are at all times prepared gladly to assist inventors in scientific research and in the practical application of discoveries.

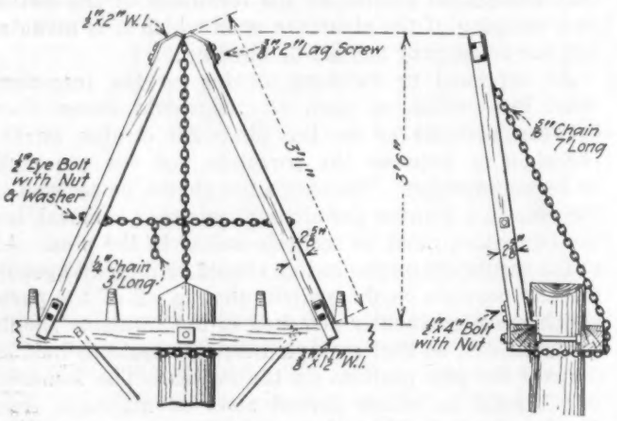
GODFREY A. P. V. WINTER BAUMGARTEN,
Rome, Italy. International Inventions Institute.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pole-Top Hoist Which Saves Time in Raising Transformers

A QUICKLY set-up crane for hoisting transformers to pole tops, in use by the Southern California Edison Company for some time, has proved to be a real time saver. The crane consists of two 2⅝-in. (6.5-cm.) side members as shown, held together by a short length of chain. The hoist is placed with the legs resting on



HOIST IS QUICKLY ATTACHED BY PASSING CHAIN AROUND POST

one cross-arm and inclined from the vertical to allow clearance when hoisting the transformers. The chain holding the crane erect is provided with a hook so that attachment may be made quickly, after which the tackle is swung from the apex ready to raise the transformer. As so many transformers are placed for distribution service, a loss of only a comparatively small amount of time on each job would give a large total during a month's period. Consequently this hoist has proved very valuable.

W. R. BATTEY,
Chief Electrical Designer.
Southern California Edison Company,
Los Angeles, Cal.

Gritty Brushes Cure High Mica on Engine-Type Generators

ALTHOUGH hard brushes were employed in several engine-driven generators which came to the writer's attention, black spots and other indications of high mica continued to exist in spite of efforts to prevent it. Finally the substitution of a brush with specifically gritty qualities stopped the trouble completely.

When the trouble first developed the commutators were turned, but the trouble came back in a different place, which proved that it was not due to shaft throw or to local causes in the commutator. Though all of these machines were equipped with hard brushes, it was finally concluded that this trouble was due to lack of ability on the part of the brushes to wear down the mica as fast as the copper. This did not seem very reasonable because this grade of brush was very hard. However, substituting another grade of carbon known to have gritty qualities cured the trouble in every case. Consultation later with the brush maker developed the fact that the original brush had no abrasive qualities whatever.

In many cases of this kind a common carbon brush will be found to give good results and for obstinate cases, undercutting the mica will surely cure the trouble. Whenever these gritty brushes are used it is advisable to put on one graphite brush per stud, staggering across the face of the commutator, for lubrication purposes.

Cleveland, Ohio. JAMES DIXON.

How to Make Moisture Tests and Evaporation Tests on Oil

AS 0.01 per cent of water in insulation oils seriously impairs the dielectric strength, a simple method for testing for water in oil is very useful. Since water is of no value as a lubricant, it has no place in lubricating oils, especially where they are purchased by weight. The two simple tests described here are a qualitative test for the presence of any water in oil and a quantitative test for determining how much water is present. In the qualitative test, a small amount of anhydrous copper sulphate (blue vitriol gently heated until it has turned white) is shaken in a bottle containing oil. If there is a trace of water present the white anhydrous copper sulphate turns blue, owing to the formation of crystallized copper sulphate.

In the quantitative test a measured quantity of oil is diluted with an equal volume of benzine in a graduated tube and the mixture is whirled vigorously with a circular motion until the layer of water which separates does not increase in volume. The graduated tube with fine divisions allows the volume of the separated water to be accurately read and the percentage to be computed. As water is somewhat soluble in benzine it is advisable first to shake the benzine vigorously with water and then separate the two by whirling in a circular motion in order to saturate the benzine with water.

The value of an evaporation test is to determine the loss of oil for compressors, turbines, transformers, etc., in operation, and to make specifications for lubricants, as the flash point is somewhat proportionate to amount of oil that will evaporize at a specified temperature.

Kind of Oil	Temperature Deg. F.	Time Hours	Loss not to Exceed Per Cent
Cylinder	400	24	2
Engine	212	4	¼ to ½
Transformer	212	5	⅛
Spindle	150	8	4

To make the evaporation test a small quantity of oil is placed in a shallow evaporating dish, accurately

weighed and heated in an air bath or drying oven. At the end of the required time the dish is cooled, reweighed, and the percentage of loss is computed. As a rule for comparing one oil with another, if the working temperature is known the test may be conducted at this temperature for eight hours and the desired information obtained. If it is desired only to know if oil of about the proper kind is being used on certain apparatus, the test may be made in accordance with the accompanying table, which gives the temperature, time and the maximum allowable loss. In making an evaporation test the size and kind of dish, the means of heating and the barometric pressure will make some difference in the result.

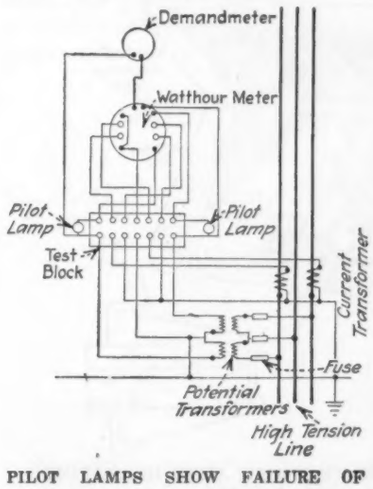
C. D. BASLER.
Consumers' Power Company,
Jackson, Mich.

Pilot Lamps Denote Failure of Potential on High-Tension Meters

FOR periodically testing the integrity of potential circuits of high-tension meters, potential transformers and fuses two pilot lamps are installed on the meter-test blocks of the Northern Ohio Traction & Light Company, Akron, Ohio. The location of these lamps and the arrangement of circuits are shown in the accompanying diagram.

In explanation of the sketch, all seven posts of the test block are normally closed. The two outside posts when closed short-circuit the pilot or indicating lamps, which are 10-watt, 110 volts or 125 volts. These two end posts are provided with spring contacts which when released cut the indicating lamps in series with the potential circuit of the watt-power meter. The lamps will not indicate unless the potential circuit in the meter and the potential transformers and fuses are intact. The construction of the test-block cover is such that it cannot be screwed in place until the binding posts have been returned.

The connection of the demand meter on three-wire, three-phase construction, as shown in the sketch, is such that failure of the potential ahead of the test block on either side will affect the graphic record and in most cases afford a definite time basis for correcting loss of registration due to failure of potential between tests. Isolating the billing meters on separate instrument transformers has made simple the use of this method of insuring proper potential conditions. Therefore, although the expense is greater, this scheme has been adopted as standard for construction on services to primary customers. No relays or indicating instruments are placed on the same transformers with billing meters. Primary meter houses, where necessary to isolate from other switchboard construction, are built by the customer from specifications furnished by the company. These specifications provide for clearness, ventilating shutters, etc. Brick and hollow tiles are used, the hollow tiles minimizing extremes of temperature.



PILOT LAMPS SHOW FAILURE OF POTENTIAL TRANSFORMER, FUSES OR METER POTENTIAL CIRCUIT

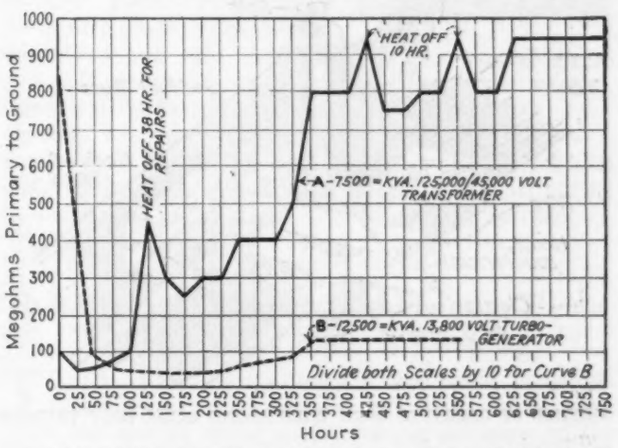
Tests of potential are made weekly on all primary metering outfits, 48 in number, over 42 miles, in about twelve working hours, by tester using motor cycle.

Northern Ohio Traction & Light Co., Akron, Ohio.

S. C. HENTON, Superintendent of Meters.

Proper Use of Megger in Drying Out Transformers and Generators

IN USING a megger when drying out electrical equipment the resistance readings must become constant before the drying is stopped. While the megger readings are affected by the voltage for which apparatus is insulated, it must be borne in mind that the form of curve given by readings taken at frequent intervals during the drying-out process, and not the numerical values of the readings, is the guide as to the progress.


Megohms Primary to Ground
Hours
HEAT OFF 10 HR.
HEAT OFF 38 HR. FOR REPAIRS
A-7500=KVA. 125,000/45,000 VOLT TRANSFORMER
B-12,500=KVA. 13,800 VOLT TURBO-GENERATOR
Divide both Scales by 10 for Curve B

FINAL SHAPE OF CURVES AND NOT INDIVIDUAL READINGS DETERMINE ACTUAL CONTENT OF INSULATION

Generally the curve will fall more or less rapidly as the apparatus warms up at the beginning and then rise slowly until the moisture has evaporated, when the curve will become constant. It must not be assumed that individual readings may be taken as a positive indication of the condition of the insulation at any given time.

Curve *A* is a typical curve taken during the drying out of a 12,500-kva., 13,800-volt turbo-generator that was delivered in December, erected during the winter and dried out in April after being subjected to extreme winter temperatures and moisture-laden atmosphere. The original reading was high, but in four hours it dropped to less than 10 per cent of starting value, continuing to drop thereafter for several hours to 5 per cent and never rising to more than 20 per cent of the original value even at the end of the run with the generator completely dried out. The slowly rising curve indicates the gradual elimination of moisture, the curve becoming flat when the moisture was completely eliminated.

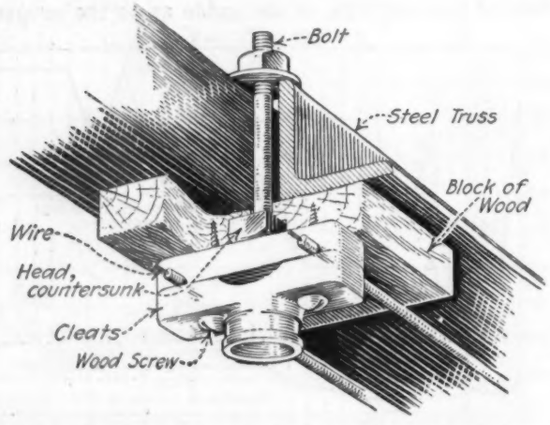
Curve *B* is that taken during the dry-out of a 125-kv. transformer. In this case trouble with the drying apparatus was encountered, resulting in marked rises in megger readings on the resumption of drying out until the transformer windings warmed up again. The general shape of the curve is similar to that of curve *A*, when allowance for the higher value of insulation for a high-voltage transformer is made.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Method of Supporting Openwork Conductors on Steel Members

FOR carrying open-wire circuits along the roof trusses and other members in modern steel-frame industrial plant buildings an economical and satisfactory type of construction is shown in the accompanying drawing. It consists of clamping a wooden block to the steel angle, struts, ties or chords by means of a through-bolt.



METHOD OF CARRYING OPEN WIRE ALONG STEEL ROOF TRUSSES

Each block is bored for the bolt and is in addition countersunk so that the head of the bolt will lie below the surface of the block. To this block the porcelain cleats can be fastened with wood screws. Small receptacles or other wiring fittings can be mounted on these wooden blocks.

The general scheme illustrated is that which has been used in many United States Army buildings erected within the last year or so in various parts of the country.

Detroit, Mich. C. WALKER.

Three-quarter-Inch Rivets Cut Electrically in Five Seconds

THE work of cutting off rivet heads in car shops of the Middle West has been greatly expedited by the use of the electric arc. It takes one man an average of five seconds to burn off a 0.75-in. (19-mm.) rivet head with the electric arc, and with a 70-volt generator the energy consumption required to do this work is 39 watt-hours. With an air buster it takes a man from thirty seconds to ninety seconds to do the same work, and it requires about five times as much energy. If a sledge hammer and cold chisel are used, it usually takes two men from five minutes to seven minutes to cut off a rivet head of the same size. After the heads have been cut off the rivets are backed out with a sledge or air hammer, preferably the latter, and the electrically cut rivets are as easy to back out as those cut by other means.

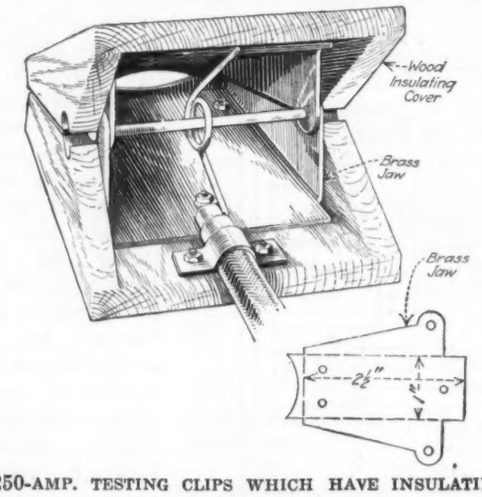
Energy is obtained from a 70-volt flat-compounded direct-current generator, and a machine rated at 1,000 amp. is sufficient to supply operators at four stations with a maximum of 400 amp. each. A grid resistance of 5.7 ohms is connected in series with each station so that on dead short circuit the current is limited to 400 amp. at 70 volts.

The operators are provided with a carbon holder containing a $\frac{5}{8}$-in. (16-mm.) graphite cutting electrode. The eyes of the men are protected by a heavy fiber or sheet-iron shield fitted with both blue and amber glass. The carbon holder is connected to the positive side of the generator and an arc is struck from the head of a rivet. The arc is maintained until the rivet head is burned off. This takes from four seconds to seven seconds, depending on the size of the rivet. A good operator will jump the electrode from one rivet head to another without breaking the arc.

St. Louis, Mo. J. A. OSBORN, Electrical Engineer.

Test Clips with Insulating Handles

A TEST clip with a capacity of 250 amp. having an insulating covering to protect the tester and to prevent short circuit with other clips has been developed by the writer for use in a New Jersey industrial plant. The two jaws of this clip are stamped out of heavy brass and bent as shown in the accompanying drawing. They are hinged together with a rivet around which is a strong spring made of steel wire which holds the jaws together. The contact edges of the jaws are rounded so



250-AMP. TESTING CLIPS WHICH HAVE INSULATING WOOD COVERING

that when more than one cable is to be connected with a clip the cables will crowd together in the center of the jaws, assuring contact against each other and preventing the clip from slipping off. These clips will hold any leads or cable ends up to 1 in. (2.5 cm.) in size. They are entirely covered with a hard-wood insulating cover

¼ in. (6.4 mm.) thick. This cover is held to the jaws by three flat-head machine screws the heads of which are countersunk against the wood and covered with insulating pitch. The wood is well shellacked, and there is no trouble from oil as is the case with soft rubber-covered clips.

These clips have proved to be useful throughout the test floor for temporarily connecting up machines. They are easy to use, and there is no danger of receiving a shock from them nor of a short-circuit between the clips.

PHILIP G. BERNHOLZ.

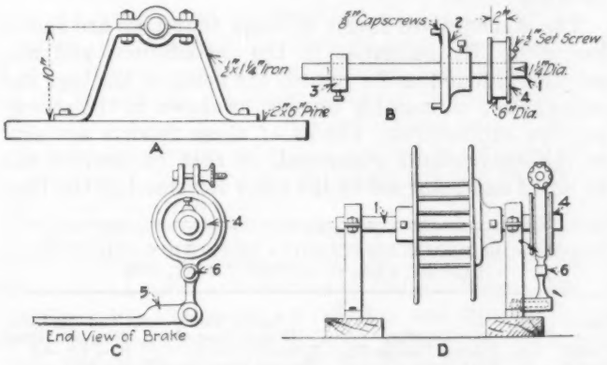
East Orange, N. J.

Stand for Holding Reel While Winding Coils

FOR holding wire reels and applying tension to the wire while winding armature coils the device described here has been developed for use in a large textile manufacturing company. The device consists of two pedestals holding a shaft for supporting the reel of wire and a brake for putting the proper tension on the wire as it is wound on the coil. The iron pedestals used for supporting the shaft (*A*) are made of ½-in. x 1¼-in. (1.2-cm. x 3-cm.) strap iron, bent as shown. The top of the pedestal is made to form half of the bearing for the shaft, and the other half is made of a similar piece of flat iron. Two bolts secure the top half to the pedestal.

The shaft itself consists of a piece of round cold-rolled steel, suitable in size for the hole in the reel, which averages about 1¼ in. The carrier (2) is preferably a casting bored to fit the shaft, and near the extremity of each arm is a ⅜-in. (1.5-cm.) cap screw, the heads of which are sawed off in order to fit into holes drilled in the side of the reel. This carrier is fastened to the shaft by means of a ½-in. setscrew. The collar (3) serves to keep the reel from lengthwise movement along the shaft.

For applying tension to the wire while the coil is being wound a 6-in. pulley (4) is mounted on the outside end of the shaft and a brake (*C*) is made to bear upon this pulley. The brake band is of cast iron and is in two halves, which are hinged at (6). One of the halves extends down to the lower arm (5), to which it



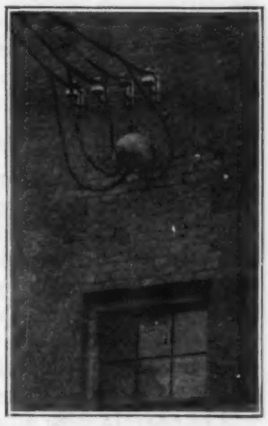
HOME-MADE REEL STAND FOR PUTTING TENSION ON WIRE WHILE WINDING COILS

is pivoted, and this arm is screwed down to the 2-in. x 6-in. pine board. The tension on the brake is adjusted by means of the thumbscrew at the top. In using the contrivance the reel should be placed on the shaft so that the wire pulls off the top side of the drum.

Glasgow, Scotland. L. E. WOOD.

Window Bricked In to Hold Service Switch

TO OBTAIN a short, direct run of service wires a Massachusetts factory purchasing central-station energy ran them through a window the top half of which was bricked up to hold the service switch inside the building, as shown in the accompanying illustration. The most convenient entrance location for the conduit carrying the service wires was at the top of this window and just below the ceiling. The leads from the transformer on the pole outside the factory were dead-ended on pin-type insulators carried on cast-iron brackets bolted into the wall with expanding bolts. From these leads drip loops were carried downward and into the conduit fitting as shown. The upper half of the window was bricked in, thus providing ample space inside for the service switch, fuses and meter clear from columns and beams and contributing to low cost of installation.



HALF OF WINDOW FILLED IN TO SUPPORT SWITCH AND METER

R. JOHNSON.

Lynn, Mass.

Subdivision of Motor Maintenance Items Which Assists Record Keeping

TO FACILITATE making out time cards on motor-repair jobs and to provide continuous information as to the cost of doing such work in the shop of the Electric Motor Repair Company, the following classification of items is used. The items may be abbreviated as desired, in order to save time in making out the cards.

All work of this kind performed in this shop is listed as provided in this classification and when making up the cost records these accounts are segregated, thereby permitting of ready comparison between different jobs.

Make-Ready.—Includes taking motor or other equipment apart, stripping, cleaning, or other work preparatory to making motor or armature ready for coils.

Insulating.—Cutting, fitting and inserting insulation.

Making Coils.—Making and shaping coils.

Taping Coils.—Coils taped before insertion.

Inserting Coils.—Inserting coils and soldering leads of coils already taped.

Taping and Inserting Coils.—Inserting coils when they are taped at the time that they are inserted and soldering leads.

Banding.—Banding and soldering band.

Testing and Varnishing.—Testing completed work; varnishing and baking out.

Refilling Commutators.—Completely refilling commutators, taking off and putting back on armature.

Repairs to Commutators.—Partially refilling or other repairing of commutators.

Repairs to Fields.—Specifying kind of work done on these.

Boxing and Crating.—Time consumed on this work.

Miscellaneous.—Making brushes, minor repairs and other items that are not properly classified under the above headings.

Springfield, Mass. J. B. TUFTS.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Pacific Power & Light Company Forms Securities Department

WHAT is to be known as the securities department was recently organized by the Pacific Power & Light Company of Portland, Ore. A manager, formerly connected with an investment banking house of Portland, has been placed in charge of the department, which will have supervision of the marketing of the company's preferred stock in the territory served. With this in view an organization will be built up by the addition of salesmen exclusively employed in the department, who will co-operate with all other employees of the company.

It is the purpose of the department to assist employees in increasing the volume of sales of preferred stock in order to provide funds to make extensions and additions to the company's service facilities.

While the company's employees generally have shown a fine spirit of co-operation in the sale of stock, the company felt that there were many of its customers and residents of the territory who could not be reached by the employees. Numbers of these could be made stockholders if the merits of the investment were placed before them. By establishing the securities department with its salesmen in the field, in addition to the efforts of other employees, the company believes that a number of new customer-stockholders will be gained.

High-Priced Coal Affects Detroit Edison's Net Earnings

EFFECTS of the increased cost and comparatively poor grade of coal obtainable are reflected in the consolidated earnings and income statement of the Detroit Edison Company for the first five months of this year. Total gross revenue for five months of 1920 was $8,701,199, a 30.8 per cent increase over the same period during the previous year. Total operating and non-operating expenses, including $385,000 renewal, replacement and contingent reserve appropriation, were $6,762,575, an increase of 41.9 per cent, making the net revenue for five months $1,938,623, or 2.6 per cent more than 1919. Interest on funded and unfunded debt was $884,512, or 28.8 per cent above last year, leaving a net income of $1,054,111, a decrease of 12.2 per cent as compared with the same period of the previous year.

The largest increase is found in operating expenses, which include coal cost. With a growth of 30.8 per cent in gross revenue there would be corresponding increases in expenses. However, the coal cost is out of proportion to all other expenses. During May of this year gross revenue was $1,669,921 and operating and non-operating expenses, the principal item of which is coal, were $1,303,900. Gross revenue increased by 37.9 per cent, while operating and non-operating expenses were 52.5 per cent more than May of last year.

Because of difficulty in obtaining delivery of contract coal the Detroit Edison Company has been forced to purchase coal in the open market at almost prohibitive prices. The fuel thus secured was often of an inferior quality, which, coupled with its high cost, resulted in excessive operating costs.

Inspection Department Is Important Factor in Good Service

BY C. B. MERRICK

CORRECT billing of customers for energy consumed and maintaining accurate records of the installations on consumers' premises is part of the service of the San Joaquin Light & Power Company. It has an inspection department whose duties are to prevent faulty installation of equipment and metering devices and to check the bills rendered to the consumer. Proper installations are assured by inspection in the field, whereby any irregularities are reported and followed up until remedied. Correct billing is made certain when the data and meter constants obtained by this inspection are checked and found to agree with the constants and readings as entered on the ledgers.

The procedure is as follows:

1. A "service order" tag is made out for setting or changing all meters.
2. An "inspection tag" is made out for checking the data as reported on the "service order."
3. Inspections of all meters are made at regular intervals from the "meter tester's reports."
4. "Complaint tags" are issued and special investigations made for all unusual fluctuations in consumption or demand, as well as for complaints of high bill, voltage or other causes.

The standardized forms of these four tags are shown herewith. Irregularities in the installations and discrepancies found in the records are noted on the tags and summarized on monthly reports, as shown in the accompanying tabulations. Copies of these reports are sent to the departments concerned, so that corrections can be noted and returned to the office for clearing the files.

TABLE I—DISCREPANCIES FOUND IN INSPECTION AND TEST TAG REPORT, FRESNO DISTRICT, MAY, 1920

Meter No.	Test Tag No.	Location	Ledger Data (Found Correct)	Test Tag Data (Found in Error)
4905	101	Johnson Lumber Co..	Demand K = 1½	K = 1.0 — ½
32547	97	Platt Hotel.....	Demand meter No. 607	No. 1607
6074	366	Standard Mfg. Co...	Demand K = 0.5 + ½	K = 0.533 —2/9
			Ledger Data (Found in Error)	Test Tag Data (Found Correct)
15551	83	City Water Company.	200-volt	100-volt
30713	105	1323 Belmont.....	No. 33713	No. 30713
36509	77	2019 Broadway.....	15 hp.....	25 hp.
1856	201	L. E. Hudson.....	Three-phase.....	Single-phase

* The ledger was corrected in the above cases to correspond with the tag data, which was found to be correct.

TABLE II—METER DEPARTMENT IRREGULARITIES REPORTED IN FRESNO DISTRICT, MAY, 1920

Meter No.	Location	Details
4905	Johnson Lumber Co., Plant No. 1	Grounded lead connected to one current coil of meter.
31776	Johnson Lumber Co., Plant No. 2	No molding over ground wire.
32547	Platt Hotel	Current transformer very hot; should be 80-amp. capacity.
4853 25076 33401	Globe Oil Co.	Three transformer banks paralleled, no secondary ground.
6074	Standard Mfg. Co.	Joint in secondary lead of current transformer not soldered.
26747	Burbank School	No door on meter box; meter exposed to the weather.
26753	Pioneer Brickyards	Part of lights connected ahead of meter on power circuit; service switch connected with blades hot.

Every new installation for power or lighting service and each reconnection of meter or service must be made on a "service order." Nothing is allowed to be connected to the lines without this order. Fig. 1 shows the form of this order, which is made out in triplicate, the duplicate and original going to the service department for meter rating and necessary instructions. The triplicate remains on the stub file, where the return of the original can be checked at any time. The cut-in man runs the service, sets the meter and does any other work

TYPES OF SERVICE, INSPECTION AND TEST ORDERS

which is required on the particular job after the transformer or secondaries are provided by the line crews. He makes the necessary notations of constant, set reading and other data on the "service order," which is then used for making up the meter and transformer records in the service department. The duplicate is held in this department for record, while the original is returned to the consumer's department for ledger entries and the clearance of the triplicate.

On completion of the ledger sheet, an "inspection tag" (Fig. 2) is made out, showing only the meter number in addition to the name and address of the consumer. The inspector visits the meter installation and fills in the rest of the inspection tag, giving meter description, reading, current and potential transformer ratios and constants, and connected load. He also inspects the meter for proper connection and operation. He then checks the record on the meter card, made from the service order, and the entry on the consumer's ledger, placing his stamp and tag number opposite the entries when found correct. This checks the accuracy of the meter data on which correct billing depends. Unrecorded connections are prevented by frequent checking to see that all "service orders" are accounted for by the inspector, and by the rigid rule that no service is connected or changed without a service order.

In addition to the inspection of meters set or exchanged, a periodic inspection of all meter locations is obtained when the regular meter tester turns in his reports. These test tags (Fig. 3) include an inspection of the meter installation, reading and constants the same as the previous tags. All irregularities, dangerous or faulty connections in installation are included in a monthly report by the meter department. As a tester completes a district the duplicates of his test tags are checked by the inspector with the ledger and meter card records. All discrepancies found in this manner are listed in a monthly report by the inspection department, showing the responsibility for the errors. By this system a periodic inspection is obtained at minimum cost.

Special investigations are made of all abnormal fluctuations in consumption or demand, either high or low, by means of the "complaint tags" (Fig. 4).

This system of inspection has proved very effective in the prevention of dangerous installations, location of defective meters or connections shortly after installation, and the correction of errors in billing constants, demands, readings and ledger entries. In addition to these direct results the psychological effect on employees has brought about greater accuracy in their work, knowing, as they do, that an inspection will follow.

Refund of Customers' Deposits

UNTIL satisfactory credit is established non-property owners and apartment-house customers of the Philadelphia Electric Company are required to make deposits against the payment of bills for energy consumed. While these deposits are held by the company interest at 6 per cent is allowed, which is credited to the customers' accounts at the end of each year. If at the end of two years a customer has not allowed his bills to become delinquent and in the opinion of the credit department has established a good credit record the deposit is refunded automatically. The Philadelphia company has found this practice to be very satisfactory to its cutsomers, and the fact that the deposits are returned without their having to request it places the company in a favorable light. With this arrangement total deposits can also be held at a minimum.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Ventilation and Temperature Problems in Large Turbo-Generators.—B. D. LAMME.—In the first part of this paper are set forth general descriptions and characteristics of radial, axial and circumferential ventilation, followed by a discussion of the flow of heat in the copper and iron parts of machines. The article is based on a paper read by the author at the 1920 convention of the A.I.E.E.—*Electric Journal*, July, 1920.

Fundamental Principles of Polarity and Phase Rotation and Voltage Diagrams of Transformers.—A. BOYAJIAN.—The article was prepared to clear up some of the difficulties and uncertainties which arise in determining transformer polarity, phase rotation and angular displacement when two or more units are to be arranged for parallel operation. The author explains the fundamental principles as applied first to single-phase circuits and then to three-phase circuits. He also discusses their bearing on parallel operation and solves problems of a practical nature.—*General Electric Review*, May, 1920.

Carbon and Commutator Wear.—R. E. HELLMUND.—It is said that although sparking voltages are the same in direct-current and alternating-current machines, the same sparking voltage may give widely different results under different conditions in either type of machine. Experiments are cited to show that the current density has an appreciable influence upon the arcing at the brushes. The influence of temperature and speed upon brush and commutator wear are also taken up.—*Journal A.I.E.E.*, June, 1920.

Present Tendencies in Turbo-Alternator Design.—J. SHEPHERD.—The writer deals particularly with the problem of ventilating turbo-alternators. He states that the application of water cooling to rotors has been put in practice by a British firm. He believes that the fire risk is thus greatly reduced on account of the fact that in air-blast ventilation any fire is rapidly spread through the whole machine. He also deals with the problem of properly insulating coils and the danger to the coils of vibration, breaking, etc.—London *Electrician*, July, 1920.

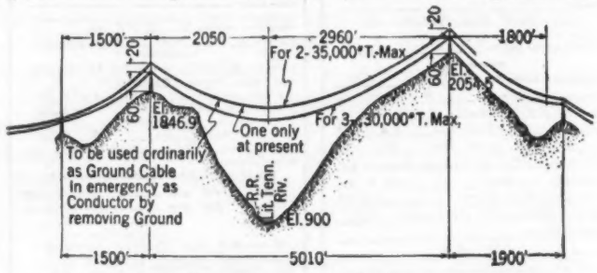
Lamps and Lighting

Maintenance of Lighting System.—A. L. POWELL.—The writer first considers the depreciation of lamp reflectors and their surroundings. He then shows how systematic cleaning is rewarded in increased efficiency of the system and saving in light. He also points out how illumination may be measured.—*Bulletin L. D.* 101 *Edison Lamp Works*, April, 1920.

Enclosed Carbon Arc Lamps Versus Novalux Mazda Units.—H. E. BUTLER.—During the period of the war and during the coal strike street lighting was curtailed in this country in the interests of economy. Two very important truths have been revealed, it is said, as the result of this experience: (1) That reduced street lighting is accompanied by an increase in crime and accidents; (2) that an appreciable waste of power exists in street-lighting systems because of the use of the inclosed carbon arc lamp. The author takes up this second matter in particular and by detailed analysis points out the wastefulness of keeping in service obsolete forms of lighting units.—*General Electric Review*, June, 1920.

Generation, Transmission and Distribution

The 150,000-Volt Transmission Line of the Knoxville Power Company.—THEODORE VARNEY.—A description of the new hydro-electric development of the Knoxville Power Company in the Little Tennessee River, which is to be part of a considerable interconnected network. The operating voltage of this network is to be 150,000. The power house provides for four generating units, of which three are installed at the present time, the generators being capable of delivering 20,000 kw. and operated at a speed of 171½ r.p.m. These generators



ELEVATION OF KNOXVILLE POWER COMPANY'S LONG SPAN ACROSS LITTLE TENNESSEE RIVER

are connected directly to the low-tension side of the transformers through automatic oil switches without a low-tension bus. Details of the transmission lines are given. In particular a long span of 5,010 ft. (1,527 m.) was installed, as shown in the illustration. The cable used was a steel-clad aluminum cable of 1.125 in. (3.2 cm.) diameter.—*Transactions A.I.E.E.*, June, 1920.

Traction

Electric Freight Locomotives for the St. Gotthard Railroad.—A detailed description, including many photographs and complete connection diagrams, of the new so-called 1C + 1C freight locomotives, which have been specially designed to comply with certain regulations requiring 860-ton trains to be hauled from Goldan to Chiasso and back inside of twenty-eight hours. The locomotives are designed for 15,000-volt, single-phase supply, at 16⅔ cycles, but the line is at present run at half the voltage to avoid insulator troubles due to smoke deposits from steam locomotives, which are still used to some extent. The locomotives develop 1,250 kw. with a quarter-hour maximum of 1,920 kw. and give a drawbar pull of 13,000 kg. (28,900 lb.), with a maximum at start of 24,000 kg. (53,000 lb.). The motors are of a compensated series type, with twelve poles, and provided with phase-displaced commutating fields. Each

locomotive has four motors, coupled to the wheels by cranks and connecting rods. A number of secondary taps on the 15,000/400-volt transformers provide for necessary speed regulation.—*Schweizerische Bauzeitung*, May 22-29, 1920.

Installations, Systems and Appliances

Recent Electric Vehicle Progress.—F. AYTON.—It is stated that in England the superiority of the electric truck for delivery and other service in urban and suburban areas has been admitted. Moreover, the soaring cost of fuel for the internal-combustion engine, not to speak of the extremely heavy cost of keeping in repair vehicles fitted with this type of motor, is giving a greater and yet greater advantage to the simple and economical "electric." The author says, however, that the electric vehicle will not be employed to the maximum extent possible until charging facilities upon an ample scale are available in every locality. He then passes to the design of electric vehicles and pays particular attention to the Steinmetz car, developed in America. The writer calls attention to the De Martis lead type of "lead-acid" battery, of Italian origin, in which it is claimed that by the use of a special paste which combines extreme hardness with great porosity that formation of lead sulphate is prevented. Other advantages claimed for this battery are higher capacity for the same weight, slightly higher voltage on discharge and increased watt-hour efficiency.—London *Electrician*, July 2, 1920.

Air Cleaning by the Cottrell Electrical Precipitation Processes.—P. E. LANDOLT and H. M. PIER.—It is said that there is an ever-increasing demand for clean air for various industrial and domestic purposes. The application of the Cottrell process to the smoke and gas discharge from industrial plants is explained.—*Journal Engineers' Club of Philadelphia*, May, 1920.

Units, Measurements and Instruments

Locating Faults in Power Cables.—K. DE KONING.—The ordinary methods for determining the position of faults in cables may give quite erroneous results for multi-conductor cables, if short-circuits exist between more than two conductors, and in particular do not apply when one of the conductors is actually broken at the fault, both ends being welded to one of the other conductors. In general different values are then obtained for the resistance in the fault, if measured from one end of the cable or from the other. The author therefore suggests that in doubtful cases resistance measurements always should be made from both ends of the cable and between every two conductors. If satisfactory cross-checks are not obtained when computing the location of the fault from independent combinations of measured data, this shows that some complication has occurred. By means of interesting examples from practice, the author shows, however, that even under very peculiar circumstances the fault may be correctly located by proper analysis of the measured resistance values.—*Elektrotechnische Zeitschrift*, April 1, 1920.

A Dynamometrical Comparator.—EDY VELANDER.—The auther deals with a differential dynamometer for accurate comparison of alternating and direct-current strengths. He states that, owing to the inherently lower precision of alternating-current measurements, more accurate results are often obtained by transferring, by means of a comparator, the alternating-current measurements into direct-current of related type. A dynamometrical comparator was devised and developed by the writer by the introduction of a special control box and the provision of means for the quick and accurate adjustment of the comparator ratio. He concludes that a comparator in conjunction with a direct-current potentiometer appears to offer the most accurate means known at the present time for the determination of the effective value of alternating currents of the order of 5 to 50 milliamperes at frequencies up to about 2,000 cycles.—*Journal A.I.E.E.*, July, 1920.

A Direct Recording Method of Measuring Magnetic Flux Distribution.—F. S. DELLENBAUGH, JR.—The method described involves the use of a revolving search coil fitted with a collecting device and operating at a high and constant speed. The coil is rotated by a small storage-battery motor fitted with a governor to control the speed and a magneto to indicate the speed.—*Journal A.I.E.E.*, June, 1920.

Telegraphy, Telephony and Signals

Cross-Talk on Long Telephone Lines.—L. LICHTENSTEIN.—After adapting the ordinary equations of electric transmission along wires to the case of two neighboring pairs of wires the author establishes solutions which permit a predetermination of the voltages induced in one pair of wires when known telephonic currents are transmitted over the other pair. The expressions refer only to the case of non-transposed lines but nevertheless are rather complicated. In special cases, however, they may be transformed to practically useful formulas. The analysis is extended also to the case of phantom lines for determining cross-talk from one pair to the phantom and vice versa.—*Elektrotechnische Zeitschrift*, March 4 and 11, 1920.

Production and Measurement of High Vacua, I.—SAUL DUSHMAN.—Rapid development during the past few years in the application of hot-cathode devices to the field of wireless telephony and telegraphy has been due in considerable part to the great progress in the art of producing and maintaining extremely high vacua. In this, the first article of the series, the author discusses fundamental principles of kinetic theory of gases which are of importance in connection with the subsequent discussions of methods for the production and measurement of high vacua.—*General Electric Review*, June, 1920.

Miscellaneous

Future of Electric Heating in Switzerland.—M. HOTTINGER.—The author analyzes the heat energy required in Switzerland's climate and finds that on an average 2,500 kw.-hr. per person in the winter season will be sufficient for heating not only residential apartments but also offices, factories, etc. For the heating alone a total of 10,000,000,000 kw.-hr. would be expended per year in Switzerland, or just one-half of the maximum total of hydraulic energy which could be utilized per year by careful development of all available waterfalls. A difficulty with electric heating is the seasonal demand, which prevents a high economy. The author does not expect a general application of electricity for heating purposes.—*Schweizerische Bauzeitung*, Feb. 7, 1920.

Electric Plowing.—GUÉDENEY.—The author describes apparatus and methods for electric plowing. He also reports on some experiments made to determine the power expenditure per acre under different conditions.—*Bulletin de la Société Française des Electriciens*, February, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

A QUIET market for electrical material prevails in all sections of the country as compared with previous weeks, but sales in no section are so low as to create alarm. A slump is reported in Seattle, and a dearth of construction exists in the Intermountain States. In the East, South, Middle West and Northwest activity is good for the midsummer season.

MORE effort in making collections is reported as necessary throughout the country, though in all sections but one business conditions are said to be satisfactory and the credit situation gives no cause for alarm. The exception is the Intermountain district, but even there the peak of the trouble is thought to be past and the crop outlook is good.

TRANSPORTATION conditions improve spasmodically, though the serious car shortage still hinders building in the South and is interfering with grain shipments in the Northwest.

SMALL stocks with a poor outlook for bettering them give apprehensions of a shortage of heating appliances in the East. West of the Mississippi supplies are in better shape. Fan sales are still off, though a hot spell has induced lively trade in the Intermountain States.

NO PERMIT within the boundaries of a national park will be granted by the Federal Power Commission until Congress has an opportunity to act. The executive secretary of the National Parks Association has denounced the bill as having a "destructive application" to the parks.

PRIVATE development and operation of the state's water powers on leases from the government and subject to regulation by the Public Service Commission are favored in the platform of the Republican party of New York State. The Democratic platform advocates state development and operation.

A REFERENDUM, held by the United States Chamber of Commerce on declarations of principle resulted in overwhelming indorsement of its industrial planks by its membership. Legal prohibition of strikes by employees of public utilities and the creation of a tribunal to settle such disputes in a binding manner were favored by 1,564 to 97 and 1,571 to 100 respectively. The open shop was also called for.

A SECOND 20,000-kw. turbine has just been installed at the Ashley Street station of the Union Electric Light & Power Company of St. Louis. Another unit of this size and also one of 10,000 kw. are to follow, probably in September.

EIGHT papers on engineering topics, besides committee reports, will be presented at the September meeting of the A. I. and S. E. E. in New York, according to the tentative program.

BOND and stock issues of electric utilities for July amounted to $24,800,000. The rate of interest of the issues, eleven in number, is from 6 to 8 per cent, and they will yield from 7¼ to 8.45 per cent.

ORGANIZATION of the International Chamber of Commerce is proceeding in Paris as a result of the meeting of 500 delegates, representing France, Belgium, Italy, Great Britain and the United States.

HOLDING that a municipal plant is not authorized to charge rates that would yield it a profit, the Maine Public Utilities Commission has disapproved an increase of 1 cent a kilowatt-hour made by the Kennebunk plant, and has ordered the old rates restored.

A WIRELESS telephone service to farmers is to be provided by the Michigan Agricultural College.

DIFFICULTIES in recruiting the required personnel from the staffs of the Department of War, Agriculture and the Interior confront the Federal Power Commission and may cause delay in organization. All interests affected by the regulations to be drafted by the commission will be called into conference before the rules are promulgated. The duties of the executive secretary have been outlined.

HIGH cost of financing and high prices of equipment will prevent any further expansion of the Detroit Edison Company after work now under way is completed, according to Alex Dow, president of the company.

RESIGNATIONS from technical employees of the Patent Office have numbered 150 in the last year, and the work is now six months behind.

SAN FRANCISQUITO plant No. 2, with an initial capacity of 35,000 kva., has been put into operation by the city of Los Angeles.

A SLIDING scale of rates on the basis of oil costs has been proposed to the California Railroad Commission by the Western States Gas & Electric Company.

GASOLINE costs are forcing more and more small plants that have been operating with oil engines to apply for central-station service, according to the Illinois Northern Utility Company.

THE MUNICIPAL plant of Seattle at Lake Union and other Pacific Coast plants may find it necessary to replace oil with coal on the ground of saving in cost.

THE PRICE of its advanced accounting course has been reduced from $65 to $40 by the National Electric Light Association.

B. E. SUNNY, president of the Chicago Telephone Company, urges that public utility securities should be exempt from taxation.

ST. LOUIS faces a grave coal shortage because of the strike in the Illinois coal mines, and the Mayor has appointed a committee of coal men, railroad men and city officials to distribute the available supply.

AN ISSUE of $5,620,000 thirty-year 6 per cent bonds has been placed on the market by the Adirondack Power & Light Company at 84½, to yield 7¼ per cent.

A 20 PER CENT surcharge to cover the extra cost of street lighting at Hartford, Conn., was put into effect Aug. 1 by the Hartford Electric Light Company, previous rates having failed to compensate for post-war costs.

REPRESENTATIVES of about a dozen utilities advocated the establishment of a service charge at a recent hearing before the Massachusetts Department of Public Utilities, seeking to repeal the existing statute prohibiting a meter charge in case electricity to the value of $9 is used during twelve consecutive months.

A REDUCTION of 1 cent per kilowatt-hour in the rates of the Kennebunk (Me.) municipal plant has been ordered by the Maine Public Utilities Commission on the ground that the proposed tariff is unreasonable.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

All Interests to Confer on Water-Power Regulations Now Being Drafted

ALL interests affected by the regulations being drafted by the Federal Power Commission will be called into conference before these regulations are promulgated. Ample opportunity will be given to correct any injustices and careful record will be made of all objections which may be voiced against any of the regulations, with the idea that means will be found to meet any worthy suggestion.

No Power Permits for National Parks Until Congress Has Chance to Act

THE Federal Power Commission has ruled that no permits will be granted within the boundaries of a national park until Congress has had an opportunity to express itself on the subject.

Robert S. Yard, the executive secretary of the National Parks Association, regards the passage and approval by the President of the water-power bill as most unhappy since it has a "destructive application" so far as the parks are concerned. Congress has turned its power over to three men, he declared. He states, however, that "so far as the present administration is concerned, the parks probably are safe, for Secretary Payne at least is uncompromising in their defense and probably will bring his fellow commissioners to his point of view, if perchance they do not already hold it."

B. E. Sunny Urges Tax Exemption on Utility Bonds

THE interest on bonds of public utility companies should be given the same exemption from federal income tax that is accorded the earnings of municipal obligations, B. E. Sunny, president of the Chicago Telephone Company, stated in an interview with a representative of the ELECTRICAL WORLD.

"This is not intended to help the rich man," said Mr. Sunny, "but the utilities must depend upon the rich for the large amounts of capital needed every year to supply the public with the service it has a right to expect. Under present conditions men with a taxable income of $50,000 would earn only 4 per cent net on a 5 per cent public utility bond at par, and to earn the full 5 per cent after paying the income tax the bond would have to be bought at about 81. The prices at which the net yield would be 5 per cent drop rapidly with increasing incomes, and with $300,000 a year the price to the investor would have to be about 46½. This accounts in a very large measure for the great depreciation of public utility securities. The public loss of revenue by making utility bonds tax-exempt would be more than made up by the resultant reductions in the rates charged for public utility service.

"The interest on municipal bonds was exempted presumably because it is paid by the people, but a much greater number of people would be affected by an exemption in favor of utility bonds. For instance, in the city of Chicago there are fewer than 400,000 taxpayers, while there are more than 600,000 gas, electric light, power and telephone customers, in addition to the hundreds of thousands who use the surface and elevated lines. There is a great similarity between municipal and public utility bonds, as both are for public service, though performed by different agencies. The taxpayers pay the interest on the municipal obligations, and the public utility customers pay the interest on the utility securities through the rates for service."

Invitations to Join Federation Out This Week

INVITATIONS were sent out on Friday to approximately 150 national, regional, state and local technical and engineering societies, with a total membership of around 225,000, to become charter members in the Federated American Engineering Societies. As stated by joint conference committee of the four founder societies, this action is in conformity with the action taken at the June organizing conference.

The invitations ask each society to name the requisite number of delegates to a meeting to be held in the fall, the exact time and place to be announced later. It was stated at the offices of the American Society of Mechanical Engineers that this meeting would take place simultaneously with the meeting of the American Engineering Council, scheduled for November.

Railroad Rate Decision Has Important Bearing on Utility Charges

OUTSTANDING among the week's commercial news was, of course, the decision of the Interstate Commerce Commission to grant to the railroads of the country a 20 per cent increase in rates. This increase is calculated to yield 6 per cent on an arbitrary valuation of $18,900,000,000 fixed by the commission. This valuation is only $1,716,000,000, or about 10 per cent, less than the valuation claimed by the railroads themselves. Estimated income from the increased rates is:

Freight (6 per cent of roads' valuation)	$1,134,000,000
Passenger fares (20 per cent increase)	233,827,982
Pullman car rates (50 per cent surcharge)	43,639,344
Excess baggage (20 per cent increase)	1,420,999
Milk transportation (20 per cent increase)	5,000,000
Total	$1,417,888,325

The effect of the decision of the Interstate Commerce Commission, which was more liberal than business inter-

ests generally and probably the railroads themselves expected, upon applications for increased rates by public utilities cannot fail to be marked. The unusually close approximation of the official to the companies' own valuation and the clear recognition of the need for restoring prosperity to the transportation arteries of the nation will be an encouragement to the utility interests subject to state control and must command the respect of the state commissions in its bearing on the similar questions that are coming before them for adjudication.

Adirondack Power & Light Puts New Bond Issue on Market

AN ISSUE of $5,620,000 thirty-year first and refunding mortgage series gold bonds, bearing 6 per cent interest and dated March 1, 1920, has just been placed on the market by the Adirondack Power & Light Corporation. These bonds are offered at 84½, to yield 7¼ per cent. They are a legal investment for savings banks in Rhode Island, New Hampshire and Vermont.

The Adirondack Power & Light Corporation does the entire electric light and power business in Schenectady, Amsterdam, Watervliet, Oneida, Saratoga Springs and many other communities in the adjacent industrial region. The company also furnishes, under long-time contracts, all the electricity used by the distributing companies in Troy and Mechanicville and by the electric railway systems in and about Albany, Schenectady, Troy, Utica and Rome, including practically all the interurban roads in the territory.

Financing for July Amounts to Almost $25,000,000

THE total of bond and stock issues of electric public utilities for July fell a bit below the average for the first six months of the year. Ten companies floated bond issues amounting to $20,800,000, and the Middle West Utilities Company placed $4,000,000 of prior lien stock on the market carrying 7 per cent and a 50 per cent bonus in common stock. This brings the July total to $24,800,000. Included in the bond issues are long-term bonds of the Duquesne Light Company and of the West Penn Power Company, the former $8,000,000, yielding 7.25, and the latter $3,000,000, bearing 7 per cent interest and yielding 7.50. This is the highest interest rate that has appeared so far this year on a long-term public utility security. The tendency toward high yields which was noticeable all through the first half of the year is still apparent. All but one of the short-term offerings yield 8 per cent or more, and this one exception, which is a 7.50 yield, is a ten-year issue. Details of the July offerings are as follows:

Company	Amount of Issue	Period
Penn Public Service Corp.	$850,000	15-year
Escanaba Power & Traction	200,000	2-5-year
Middle West Utilities Co.	4,000,000	
Municipal Service Co.	650,000	3-year
Duquesne Light Co.	8,000,000	30-year, dated July 1, 1919
Utica Gas & Electric Co.	1,700,000	5-year
Louisville Gas & Electric Co.	3,500,000	2½-year
United Electric Light Co.	1,000,000	10-year
Continental Gas & Elec. Corp.	1,400,000	2-year
West. Penn. Power Co.	3,000,000	30-year, dated March 1, 1916
Cincinnati Gas & Elec. Co.	500,000	3-year, dated Dec. 1, 1919
Total	$24,800,000	

Class of Security	Rate of Interest	Per Cent Yield	Offered at
First and refunding gold mortgage bonds	7½	8	95½
Secured convertible serial notes	7	8	...
Prior lien stock with 50 per cent bonus in common stock.	7		90
Coupon notes	8	8.30	99½
First mortgage and collateral trust gold bonds	6	7.25	85
General mortgage bonds	7½	8	98
Bond-secured gold notes	8	8.45	99
Coupon gold notes	7	7.50	96.53
Convertible trust notes	7	8.10	98
First mortgage gold bonds	7	7.50	94½
Gold notes	7	8	97½

St. Louis to Distribute Coal to Utilities and Others

WITH only a few days' coal supply on hand where in previous years there was always ample storage, St. Louis, in consequence of the Illinois coal strike, is facing an acute shortage. As a result Mayor Kiel on July 29 appointed a committee of coal men, railroad men and city officials to take over the coal in the St. Louis switching limits and distribute it to public utilities and the essential food and steam consumers. Some coal is being brought in for railroad use from the Southeast and from western Kentucky and will be distributed by the committee.

No Further Expansion in Detroit at Current Money and Material Costs

WHEN the extensions and additions to its plant, substations and distribution system now under way are completed, the Detroit Edison Company plans to curtail further improvements. This policy has been adopted, Alex Dow, president of the company, said to a representative of the ELECTRICAL WORLD, because of the present cost of financing and the high prices of all equipment and apparatus. Thus far, Mr. Dow said, the Detroit Edison Company has been able to secure funds for new construction at a rate of interest under 7.5 per cent, but in the present money market a rate of at least 8 per cent and probably more would have to be paid. To invest such costly money in just as high-priced equipment he believes would be ill-advised. Five years hence, after an adjustment of values, a utility would find itself seriously handicapped with an investment in equipment whose cost would be out of all proportion to its reproduction value at that time.

All improvements that have been promised to power users are to be completed, and the Detroit Edison Company will be in a position to handle its present business. However, additions to its plants looking to an extensive expansion of the company's business will be delayed until conditions are more nearly normal.

Idaho Power Company to Make Extension

THE Idaho Power Company is completing surveys for a 66,000-volt double-pole line from the Thousand Springs plant 115 miles west into the Hageman Valley, where many new irrigation consumers will be served. The financing was through the recent sale of $2,000,000 of 8 per cent first and general lien bonds. The line is to be in operation by July 1921 and is designed for an ultimate voltage of 132,000.

Federal Power Commission Organization

THE heads of the divisions into which the Federal Power Commission is divided are to be known as the chief engineer, the chief accountant, the chief counsel and the chief clerk. The chief engineer will be in immediate charge of the engineering division. This place will be filled by Lieut.-Col. William Kelly, who has been detailed as the engineer officer of the commission. Colonel Kelly will arrive in Washington Aug. 15.

For the present at least the accounting and statistical divisions will be combined. The organization of these divisions may have to be delayed until Congress gives authority to employ personnel. The most important item of work under this division will be the formulation of a system of accounting. This will involve a critical review of the accounting systems of the several states and the adaptation of the commission's system as far as practicable to those of the states. The head of this division must be a man who has had thorough training in the theory and practice of public utility accounting. The work will call for technical qualifications of a high order. It is not regarded as probable that an employee can be found in the Department of War, Agriculture or the Interior with the training or the experience which would qualify him to perform this work. It will be necessary, therefore, either to obtain the temporary detail of some qualified person from the Interstate Commerce Commission, which has on its staff a number of specialists in valuation, or to employ some one from outside the government service.

The accounting system and its operation are fundamental features of the act and will be involved in the issuance of every license, the operation of every project and in the action taken toward regulation of rates and securities.

The general statistical work will be a matter of development. Information concerning water-power resources, utilization and distribution is far from adequate. The commission will attempt to develop this branch of its activity in co-operation with the industry, with the public utility commissions of the states and with other government agencies.

The licensing and legal division probably will be handled by assignment of a properly qualified man from the War Department. This division will be concerned with all legal matters affecting the work of the commission. It probably will have charge of the preparation of all permits and licenses and of their extension, transfer, termination and revocation. Many important legal questions are certain to arise. Among these will be the relation between the authority of the commission and that of the several states; interpretation of state laws, such as those covering water rights, water-power franchises and certificates of public convenience and necessity; assistance in the conduct of judicial proceedings, particularly in connection with the valuation of properties and decisions on international questions. For these purposes knowledge and experience in the workings of the public land law, the law of waters, public utility statutes and government practice and procedure are highly desirable.

The regulatory division will deal mainly with rates, service and security regulation. Since these matters will not develop until later, there is no immediate need for the organization of that division.

The operation division will handle the details of office matters, such as care of quarters, procurement of equipment, letterheads, seal and general supplies; maintenance of files, record and library; preparation of annual reports, handling of details of advertisement of applications, and appointment, transfer and regulation of personnel.

The act requires that before an application is granted public notice shall be given in writing to any state or municipality likely to be interested. In addition, notice must be published for eight weeks in a newspaper published in the county or counties in which the project is situated. This work will have to be begun at once. The commission will have a formal session each second and fourth Monday.

Duties of Executive Secretary of Federal Power Commission

AT THE last meeting of the Federal Power Commission the duties of the executive secretary were outlined as follows: To administer the act as executive officer of the commission and to see that the rules and regulations of the commission are carried out; to supervise under the act and regulations all personnel that may be employed by or detailed or assigned to the commission and to prescribe their duties within the limits of the act and regulations; to have general administrative charge of the conduct, preparation and publication of all investigations, hearings, valuations and reports authorized or required by the act, unless otherwise provided by the commission; to approve vouchers for expenditures incurred on account of salaries or expenses payable under the provisions of the act; to administer oaths and affirmations, examine witnesses and receive evidences; to formulate, authenticate and record the findings of the commission provided for in the act; to attest all orders, decisions or regulations of the commission and to certify under seal copies of such orders, decisions or regulations, or of any finding, report, map, plan or other record of the commission, whenever required for any lawful purpose; to execute and issue permits and licenses under the seal of the commission; to approve under the seal of the commission voluntary transfers of licenses or of the rights thereunder granted, and to cancel or terminate permits or licenses under the conditions prescribed in the act.

Water-Power Districts

THE Federal Power Commission has divided the county into five districts as shown above, with headquarters at which branch offices will be maintained as follows: No. 1, Washington; No. 2, St. Paul; No. 3, St. Louis; No. 4, Denver; No. 5, San Francisco.

Iron and Steel Electrical Engineers Adopt Tentative Program

FOR the fourteenth annual convention of the Association of Iron and Steel Electrical Engineers, which is to be held at the Hotel Pennsylvania, New York City, on Sept. 20 to Sept. 24, a tentative program has been adopted containing these papers: "A Condensed History of Ore and Coal Loading and Unloading Machinery," by W. K. Monroe; "The Reversing Electric Mill Considered from the Standpoint of Tonnage," by K. A. Pauly; "Power Transmission for Industrial Plants," by D. M. Petty; "Centralized Turbine Generating Stations for Steel Mills," by T. E. Keating; "Some Considerations in the Determination of Auxiliary Drives," by Gordon Fox; "Relation of Standardization in Electrical Equipment to Safety," by Walter Greenwood; "Underground Transmission," by A. L. Freret, and "Current Limit Reactance," by R. H. Keil.

E. S. Jefferies will present the report of the electrical development committee for 1920, E. T. Moore the report of the electric furnace committee, W. T. Snyder the report of the standardization committee, and the educational committee will deal with the practical education of steel-mill electricians.

Consider Replacing Oil by Coal on Pacific Coast

NOT a few electric light and power plants on the Pacific Coast are considering the use of coal in place of fuel oil. A number of inquiries for stokers, it is learned, have recently been received for this section.

The City Council of Seattle, Wash., is discussing a plan to substitute coal for fuel oil at the Lake Union steam-power plant. N. D. Moore of the Pacific Coast Coal Company has presented estimates of the cost of changing the plant over to coal, placing it at approximately $650,000. Mr. Moore recommends the use of powdered coal at this plant. He further asserts that coal can be delivered at the plant at $8 per ton and that one ton of this coal is equivalent to 3.4 barrels of fuel oil in heating value, which would result in a saving of 20 cents on each of the million barrels of fuel oil used each year.

Municipal Plants Not to Make a Profit, Declares Maine Commission

RATES established by the Kennebunk (Me.) municipal lighting plant last December are declared unreasonable in a finding of the Maine Public Utilities Commission issued July 20, and a re-establishment of the rates formerly in effect has been ordered. Under the old schedule the commercial lighting rate was 9 cents per kilowatt-hour in case the customer owned the meter and transformer, and 10 cents otherwise. Power rates ranged from 7 cents to 5 cents per kilowatt-hour where the customer owned the transformer and meter and from 8 cents to 6 cents otherwise. These rates were raised 1 cent per kilowatt-hour each, and the board was appealed to by customers.

The commission investigated the conduct of affairs at the plant and found it unbusinesslike. The total assets on Jan. 1 last were $87,568. The town plant represents a property investment of $79,000, upon which exists a mortgage of $12,000. The commission holds that the city is not authorized to charge rates which would yield a profit upon the investment, points out that no difficulty will be experienced in refunding the mortgage bonds, and states that the rates should be sufficient only to cover the cost of operation, maintain a sinking fund and set aside a reasonable amount for depreciation and working capital. Operating revenue for 1919 was $15,267 and operating expenses were $9,503. The net income after bond interest was $6,773, representing a return of between 7 and 8 per cent on the outside value of the property. After studying former accounts, the commission finds that under previous rates the town was not only able to pay all its operating costs but to provide a sufficient margin for sinking fund and depreciation and leave an amount for working capital larger than necessary. No special rates for street lighting were included in either the old or the new tariffs, and the commission points out that such rates should be provided and on a basis comparable with charges for street lighting in other communities. In the decision the board emphasizes the inadequacy of accounting methods followed by the municipal plant and points out the necessity of establishing direct management under one person and providing for a proper check upon the purchasing, receipt, storage and use of materials and supplies.

Gasoline Cost Drives Municipalities to Central-Station Service

INCREASING fuel and operation costs are rapidly turning the minds of those now dependent upon electric power derived from individual plants to public utility sources of supply, it is reported by the Illinois Northern Utility Company. Numerous small municipalities which have been operating electric light plants, generating power by gasoline-driven motors, have applied for service to this company, giving the increased cost of gasoline as a reason. Similar conditions are noted where manufacturing plants are finding that it is cheaper to provide for their power needs by using central-station supply.

Among the municipalities which have recently applied to the company for service are Fairdale, Monroe Center and Davis Junction, all in the Belvidere district of the company's territory.

Wireless Telephone to Improve Farm Living Conditions

BY MEANS of its wireless telephonic transmission station Michigan Agricultural College is about to make a dream come true. Plans are under consideration to inaugurate a system of wireless telephony whereby the farmers of the state may be kept informed as to the market prices of their products, receive weather forecasts and even "listen in" to hear music or lectures on practical and scientific topics such as are delivered at the college. Some fifty instruments are installed at the present time around Lansing. A system is being worked out whereby all the farmers of the state may eventually obtain instruments from the college to receive radio transmitted. The instruments are much less expensive than those required for transmission.

International Chamber of Commerce Preparing for Work

UNDER the direction of Dr. Edward Dolleans of the University of Dijon, who is temporary secretary-general of the International Chamber of Commerce, assisted by David A. Skinner, secretary of the Chamber of Commerce of the United States, the work of setting up the machinery of the newly organized chamber is under way in the temporary headquarters in Paris. Five hundred delegates from the five foundation countries—France, Belgium, Italy, Great Britain and the United States—met at the convention which organized the body and large results in matters affecting international production and distribution are anticipated from its operation. Among the objects which it has set before it are the promotion of import and export trade and its safeguard against waste and fraud, the standardization of international commercial documents, practices and laws, the removal of international friction arising from commercial differences, and the increase of the world's production and of the availability of its products to consumers everywhere. A board of three directors and three alternates from each of the countries represented will constitute the executive body.

Resolutions adopted urged colaboration between business bodies and their respective governments, favored the establishment of a bureau of exchange of foreign credits on the basis of reciprocal relations for the use of exporters, condemned existing inequalities of treatment granted to foreign banks in different countries, advocated special concessions to promote prospecting for new sources of petroleum and provided for the investigation from a legal standpoint of the mischievous use of trade names.

In addition the following recommendations were made to all countries: To hasten the utilization of hydroelectric power in every possible way; to hasten the carrying out of the measures which tend to have mineral fuel used in the most scientific and economic way, and to develop to the utmost the coal resources of the world.

Additional Capacity Installed at St. Louis

THE original 12,000-kw. station built by the Union Electric Light & Power Company of St. Louis in 1902 will have its generating capacity increased to 128,000 kw. when a 10,000-kw. unit and another 20,000-kw. unit are put in service next September. The second 20,000-kw. machine (No. 8) was tested at the station last week preparatory to putting it into service.

The Ashley Street station was originally equipped with five cross-compound Corliss-engine-driven generators aggregating 12,000 kw., and two years later the capacity was trebled by the installation of additional boilers and six Curtis turbines. These were replaced in 1911 by machines of about twice their size. About four years ago plans were made to remove the old engine units and small turbines to make room for three 20,000-kw. and one 10,000-kw. turbine. One of the 20,000-kw. turbines has been in operation for about a year, another, as just stated, is now being put in service, and it is expected that the two remaining units, one of 10,000 kw. and one of 20,000 kw., will be installed before the end of September.

Chamber of Commerce Declares for the Prohibition of Utility Strikes

RESULTS just published of the referendum to the membership of the United States Chamber of Commerce of two recommendations of the chamber's committee on public utilities declaring for the prohibition of strikes of public utility employees and for the creation of a tribunal to settle labor disputes arising in utilities show that they were carried by overwhelming majorities. The first recommendation, on which the vote was 1,564 to 97, reads as follows:

"The committee recommends that strikes by employees of all public service corporations performing public service essential to the lives, health, security, comfort and well-being of the people should by law be explicitly prohibited."

On the second recommendation the vote was 1,571 to 100. It reads:

"The committee recommends that suitable tribunals should be created by law to adjudicate differences between the employees of public service corporations and their employers and that the decisions of such tribunals should be final and binding upon both parties."

In addition to these two propositions, a platform containing twelve principles of industrial relations was submitted to the membership, each paragraph being voted upon separately. All were carried by a vote approaching unanimity, from two to fifty-four representing the strength of those opposing them, while the affirmative vote fell below 1,600 in only one instance. These twelve principles are substantially as follows:

1. The right of every person to engage in any lawful business or occupation, individually or collectively, either as employer or employee, subject to limitation only through a valid exercise of public authority.
2. The right of open-shop operation.
3. The equal right of all to associate voluntarily for the accomplishment of lawful purposes by lawful means, but with no denial of the right of those who do not desire to act or deal with them.
4. Associations or combinations of employers or employees to be equally subject to the authority of the state and legally responsible to others for their conduct and that of their agents.
5. Condemnation of restriction of productive effort or of output.
6. The duty of managements to co-operate with the workers in all practicable and reasonable ways to increase the value of their productive effort.
7. Reduction in working hours below a carefully ascertained economic limit should be made only with full acceptance of the fact that it involves a commensurate loss in the earning power of the workers and an increase in the cost of the product.
8. Adequate means satisfactory to both sides for the just and prompt settlement of all disputes.
9. Representatives of either employer or employees should not be chosen or controlled by, or in any degree represent, any outside group or interest in the questions at issue.
10. The successful conduct and full development of the particular industrial establishment in which employer and employees are associated must be sought.
11. Community welfare demands that no combination to prevent or impair the operation of government or of any government function shall be permitted.
12. In public service activities the public interest and well-being must be the paramount consideration. The power exercised by the state over the corporation should extend to the employees to assure adequate, continuous and unimpaired operation of public utility service.

Patent Office Six Months Behind

DURING the past year there have been 150 resignations on the part of the technical employees of the Patent Office. Among these was that of the Commissioner of Patents, James T. Newton. During the past fifteen months business in the Patent Office has increased 50 per cent. The force of examiners would be inadequate even if all the positions were filled, but more than one-fifth of these positions are vacant through inability to interest technical men at the salaries paid. The work of the office is said to be six months behind. Protests from the industries which must use the Patent Office are growing in volume.

Pennsylvania Commissioner Declares 7 per Cent Utility Return Not Enough

DISSENTING from the decision of the Public Service Commission of Pennsylvania in establishing rates designed to bring a 7 per cent return to a water company, Commissioner John S. Rilling declared that in existing conditions this standard of earnings does not meet that contemplated by the public service company law of the state. Mr. Rilling's view was that owing to the depreciated purchasing power of money a 7 per cent return means a greatly reduced income to owners of utilities and that a poorly paid utility cannot render efficient service. While he did not hold that an 8 per cent return is necessary in every instance, he was emphatic in asserting the right of public service companies, which cannot discontinue service without the consent of the state, to an adequate income.

N. E. L. A. Reduces the Price of Its Advanced Accounting Course

IN ORDER to introduce thoroughly throughout member companies its advanced accounting course, the National Electric Light Association has reduced the price thereof from $65 to $40.

It is expected that a great many of the member companies will take advantage of this opportunity to establish classes in advanced accounting. This course consists of thirty-six lessons and follows carefully the best practices of progressive light and power companies.

The price of the elementary accounting course remains the same as formerly, the complete course costing $16, and groups of ten or more sent in at one time $14 per course. For the beenfit of the industry as a whole the association last year removed all the restrictions as to enrolment in these courses, and they are now open to all those who may apply at the regular association prices.

New York Republicans Oppose State Development of Water Power

MEETING at Saratoga Springs last week, the Republican party of New York State adopted a plank declaring for private development and operation of water powers, title to which, however, should remain vested in the state. It also asserted that where industrial disturbances menace the "health or existence" of the public, both employers and employees must realize that the public right is higher than their own and that "the right of the people to continuous and adequate service in transportation, food, supplies, fuel and other necessities of life must be maintained unimpaired."

The water-power plank follows:

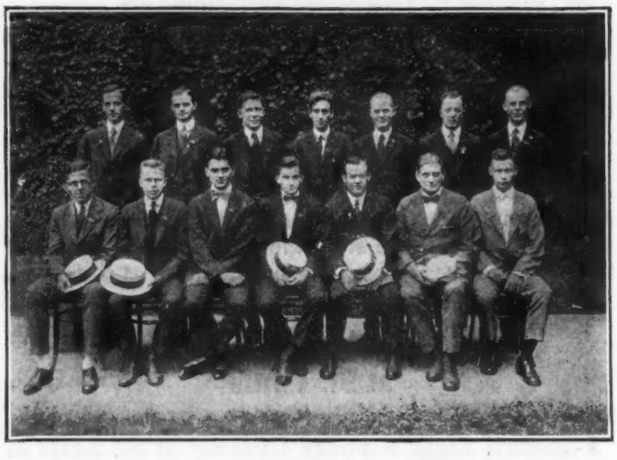
"The state should never again part with the title to any of its remaining water powers, but they should be developed and operated by private capital on leases fair both to the state and to the operating corporations, and such corporations should be regulated by the Public Service Commission as to capitalization, rentals and rates."

The platform of the Democratic party of New York, adopted at Saratoga Springs on Wednesday of this week, takes direct issue with the Republican platform and demands the development and distribution of water power by the government of the state. It says:

"The Democratic party has always stood for the conservation of our forests and natural resources. We reiterate our support for the development and distribution by the state of hydro-electric power for the benefit of the people. The Republican Legislature has twice refused to enact legislation proposed by Governor Smith to accomplish this purpose and has attempted to substitute therefor the exploitation of the state's water resources for the benefit of those influential enough to obtain franchises therefor.

"We commend Governor Smith's veto of the Sage bill, which attempted to revive privately owned and practically dormant charters affecting the border waters of the state."

Engineering Professors Taking Westinghouse Summer Course



ENGINEERING professors from fourteen colleges and thirteen states are in attendance at the summer course for engineering teachers held by the educational department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh. This course is designed to give engineering professors the advantages of practical experience in manufacturing. Lectures are given by heads of the various departments of the company, and the professors are able to combine theoretical and practical knowledge to their advantage.

Professors taking the course and their colleges are as follows: S. W. Anderson, Virginia Military Institute; William Anderson, Rhode Island State College; G. C. Blalock, Purdue University; B. B. Brackett, South Dakota State College; R. E. Brown, University of Pennsylvania; P. H. Burkhart, University of Illinois; J. M. Coahran, State University of New Mexico; P. H. Daggett, University of North Carolina; M. M. Flanders, Bliss Electrical School; V. B. Hall, Bucknell University; W. B. Hall, Sheffield Scientific School; J. H. Mustard, University of North Carolina; W. L. Teague, University of Arkansas, and F. G Tucker, State College of Washington.

More Rate Raises.—Among increases granted to electric light and power companies recently by public service commissions are one of 30 to 50 per cent to the local companies at Montgomery, Ala., and one of 24 to 30 per cent on lighting and of 55 per cent on power to the municipal plant at Richmond, Ind.

Wireless Stations of United States Government.—There are eighty-eight shore wireless-telegraph stations belonging to the federal government, not including twenty in Alaska, nineteen in the Philippines, three in the Canal Zone, two in Hawaii and one each in Porto Rico, Guam and Samoa, or a total of 135. The government ship stations number 470.

Natural Gas May Help Save Fuel Oil in California.—Power companies in the central part of California are interested in a project of the California Natural Gas & Development Company to build a pipe line from the oil fields and gas fields around Tulare Lake to San Francisco to furnish natural gas to the industries around the bay. Such a plan would mean the conservation of a large amount of fuel oil for the standby plants of the large power companies.

Uniform Accounting Systems.—The Public Service Commission for the State of New York, First District, has issued three booklets containing the uniform systems of accounts as prescribed by it for electrical corporations, street and electric railways and gas corporations respectively. The first-named of these publications contains seventy-four pages and gives the final order and four modifying orders governing electrical company accounting, the last of these modifying orders bearing date of June 29, 1917.

Electrification of Belgian Railways.—The first step in an extensive program of electrification of Belgium's railroads will be to substitute electricity for steam in the passenger service between Brussels and Antwerp, involving 27 miles of double track. The government plans call for thirty-eight trains a day in each direction, each train with a seating capacity of 500 persons. An average speed of 40 miles an hour is to be maintained, with a maximum of about 54 miles. Freight service will follow, and the project calls for the gradual extension of electric traction over the kingdom until the steam locomotive shall become a thing of the past.

North Dakota's Governor Installs Wind-Driven Electric Plant on His Farm.—Gov. Lynn J. Frazier of North Dakota has installed on his farm near Hoople a wind-driven electrical plant for heating and lighting his home and operating his farm machinery. This plant, designed by George Manikowska, a North Dakota farmer, is operated in connection with a storage battery and is said to utilize almost 100 per cent of the available power of the wind, storing energy derived from surplus velocity for use in periods of calm. A similar plant is said to furnish light for 120 incandescent lamps, run a washing machine, cream separator, vacuum cleaner, flatiron and fanning mill, pump water for 200 head of stock and light a church. The machines are coming into use on farms throughout North Dakota.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A New Manitoba Transmission Line.—A 60-mile transmission line from a municipal substation in Winnipeg, Manitoba, to Portage la Prairie, a town of 6,000 people, is almost ready for operation and will ultimately supply power for an installation with a capacity of 6,700 hp. This will supplant the old municipal plant of Portage la Prairie, rated at 960 hp., which will be kept as an emergency reserve.

Water-Power Commission for Province of New Brunswick.—Development of the water powers of the Province of New Brunswick, Canada—notably the Lefreaux, east of St. John, and the Pokiok, near Woodstock—is to be pushed by a commission appointed by the provincial government. C. O. Foss, St. John, N. B., will be chairman and chief engineer and C. W. Robinson and Reid McManus of Moncton, N. B., the other members.

Electrical Homes in Demand in San Francisco—The success of the sample "electrical home" in San Francisco has led its promoters to start construction of five more homes that will be as completely wired and have as many convenience outlets as the original one. The new homes, situated in St. Francis Wood, are provided with double-wiring circuits for illumination and power appliances. More than 18,000 visitors passed through the first electrical home in the short time it was on exhibition.

An International Water-Power Source.—The Duero River, which for more than 90 miles forms the boundary between Spain and Portugal, has along that stretch a total fall of 1,350 ft. and thus is a valuable source of potential power, though the volume of water varies greatly with the season. A Spanish syndicate is now seeking to develop this portion of the river, which, it is said, will afford 300,000 hp.; but an international difficulty has arisen, the Portuguese government claiming that under an old treaty half of the power developed would belong to Portugal, which would thus acquire 150,000 hp. without any expense to itself. The Spaniards offer Portugal the equivalent of half the power of the natural waterfalls, or 35,000 hp., but insist that the reward of Spanish capital and labor should accrue to Spain.

Exportation of Hydro-Electric Energy from Switzerland.—Opposition to the exportation across the frontier of the surplus power developed in the summer months by the hydro-electric plants of Switzerland has become so strong that the Swiss government has put severe restrictions upon it, although it has refused to prohibit it entirely. Swiss electrical manufacturing firms hold that any surplus energy should be converted into heat to save coal, and that the general development of the industry that this would bring about is of greater importance to the country than the development of large power companies.

Radiographs of Steel Reveal Hidden Flaws.—Announcement is made that by means of the Coolidge X-ray tube research workers have discovered a flaw in a steel casting that was invisible to the eye. Surface radiographs of a large casting weighing almost a ton showed markings that appeared to indicate blow-holes in the interior. A circular piece an inch in diameter was therefore punched from the casting at one of the points apparently defective, and on this being radiographed a light streak appeared, clearly disclosing the existence of the hole. Great usefulness is predicted for this method when it comes into more common use for testing cast metals.

Hydro-Electric Construction Under Way and Contemplated.—Work is reported as progressing upon the Georgia-Alabama Power Company's dam and power house on the Flint River at Albany, Ga., which will cost about $1,000,000, and upon the same company's hydro-electric development on Pataula Creek, 9 miles north of Fort Gaines, Ga. Dams are being built for hydro-electric purposes across the Chattahoochee River at Riverview, Ala., and across the Oconee River at Milledgeville, Ga. A hydro-electric plant on the Big Niangua River, 120 miles from Kansas City, Mo., to develop 38,000 hp., the electricity generated to be transmitted throughout the district, is another project with good prospects of early realization.

A Proposed Experiment in Technical Education.—A change of policy favored by the education committee of Manchester in the conduct of the Manchester College of Technology, and adopted by the City Council, meets with the condemnation of the London *Electrician*, speaking no doubt for the great majority of English technical men and engineers. The college, which has ranked high, has accommodation for 240 students. The committee, against the protest of the principal of the college, proposed to limit the number admitted to the degree courses to 110, although there are said to be plenty of candidates, and to devote the remainder of the facilities of the school to the training of young boys by means of two-year courses, the latter to be known as "non-degree" students. The adoption of this program was followed by the resignation of the principal.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Item Representing No Tangible Property Disallowed as Part of Rate Base.—The New York Public Service Commission, Second District, has refused to include as a part of the rate base of a natural-gas company an item of $100,000 which, the commission says, does not represent any property that can be located, notwithstanding that this item was allowed in 1906 by the then existent Commission of Gas and Electricity.

Five per Cent for Depreciation, 6.3 per Cent for Interest.—In granting an increased rate schedule to the Fayetteville Gas & Electric Company, the Arkansas Corporation Commission declared that to attempt to require the company to continue to operate at the old rates would be to force a complete breakdown in service. The commission found that the proposed rates would allow 11.3 per cent on the valuation accepted as a rate basis, divided as 5 per cent for depreciation and 6.3 per cent for interest, which figures were held to be reasonable.

Crossing a Railroad with High-Tension Wires.—In Buffalo & Susquehanna Railroad Corporation vs. Dubois Electric Company, the Pennsylvania Public Service Commission has held that a railroad whose facilities are paralleled, crossed and recrossed by the high-tension lines of an electric company in such a manner that they may cause inductitve interference with the ground telephone and electric signal systems of the railroad may file a complaint with the commission in order that the rights of the parties may be determined. The sum of $16 per annum for each crossing over the right-of-way and tracks, except such crossings as occur at established highways, was found by the commission to be a just and reasonable charge against the electric company and was ordered paid.

Heavy Line Loss as Affecting Rates of Small Company.—In a complaint made against the rate of 14 cents a kilowatt-hour charged by the Wynantskill Hydro-Electric Company of Rensselaer County, N. Y., which, in addition to purchasing power for distribution, has a water-power plant with steam auxiliary and 20 miles of line, serving 325 customers, it developed that transformer and line losses were so heavy that only about 45 per cent of the power generated reached the customers. The complainants held that a portion of this heavy loss should be borne by the company. The Public Service Commission for the Second District of New York estimated that even at the rate charged this was already the case and permitted the charge to stand as a maximum until further order from the commission.

Abandonment of Service Forbidden.—The Arkansas Corporation Commission has ordered the Mays Manufacturing Company to continue its service in the city of Leslie, where it has a fifty-year franchise which it desired to abandon because the commission had denied its petition for an increase in rates, on the ground of insufficient evidence. Pointing out that the owner of the company could renew his application at any time with proper evidence but had chosen instead to discontinue business, the commission declared that the great weight of legal authority was to the effect that a public service company which has accepted a franchise from a city or state cannot discontinue service at will but must comply with the terms of the franchise as fully as must the city or the state on its part. The fact that an individual instead of a corporation was operating the plant made no difference.

Establishing Depreciation Reserve by Means of Sinking Fund.—In an instance where a public utility had not in the past established a depreciation reserve, the Railroad Commission of Wisconsin directed that provision for depreciation should be made upon a sinking-fund basis, this basis assuming that a part of the earnings remaining after direct operating expenses have been met will be credited to the depreciation reserve so that it will be built up in part by direct charges to operating expenses and in part by interest credited to it. Depreciation reserve, the commission explained, has no relation to the installation or construction of new equipment but only to the removal or abandonment of worn-out, obsolete or inadequate property, the original cost of which should be credited to the appropriate plant account and charged to the depreciation reserve when equipment is retired from service.

Valuation of a Seldom Used Standby Plant Objected To.—In granting a revised schedule of rates to the Douglas County Light & Water Company, the Public Service Commission of Oregon found fault with an item of $64,685 included by the company in its valuation figures as reproduction cost new of a small hydro-electric unit acquired as the result of competitive conditions many years ago and now seldom used, a standby steam plant being sufficient in all ordinary emergencies. It was shown, however, that under unusual conditions the small water-power plant had effected a saving in fuel when used instead of the steam plant, and the commission therefore ordered that, instead of including an allowance for its value, a rental should be allowed for its use equivalent to any actual saving effected thereby, such rental to be charged to operating expenses and credited to non-operating revenue.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Judge Refuses to Hinder Seattle's New Plant.—In overruling the demurrer of Whatcom County to the amended petition of the city of Seattle to condemn certain lands in the Upper Skagit Valley for the building of a big electric plant there, Judge Edward F. Hardin in the Superior Court of the State made the comment that the claim of the county that it might be deprived of some of its taxable property was "narrow and unwarranted." The court stated that the county had no right to anticipate that Seattle was going to violate the state laws.

Circumstantial Evidence of Contributory Negligence Not Necessarily Conclusive.—In a suit against the Citizens' Light, Heat & Power Company of Salisbury for damages because of the death of a man electrocuted by a high-tension wire which had fallen to the ground along a pathway beside a public road, the trial judge entered judgment for the defendant, holding that a clear case of contributory negligence was established by the attitude of the dead man, who appeared to have grasped the fallen wire "from motives of curiosity." The Supreme Court of Pennsylvania has reversed this judgment, declaring that other evidence showed the man to have been aware of the danger from the wire, that the presumption was he did not purposely run into harm, and that the testimony must be read in the light most advantageous to plaintiff and the benefit of every doubt be given to him. (110 A. 372.)

Responsibility for Damages Caused by Fire Set by Employees.—A somewhat unusual case came before the Supreme Court of California recently when judgment against the San Joaquin Light & Power Corporation for damages arising because of a fire started in that company's right-of-way by men alleged to be employees of the company was affirmed. The fire destroyed standing grain, and an insurance company which had issued a policy on the crop sued through the owner of the grain for the amount of loss. The electric company maintained that there was no proof that the men held to have started the fire were its employees or, if they were, that they had started the fire or negligently permitted it to spread; but the court held these allegations to be sufficiently established by evidence to the effect that the men had been seen working on the transmission-line poles with a team and wagon near by and a fire pot and torch on the ground. (190 P. 198.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Lorin E. Imlay, who has been appointed division engineer in charge of the power transmission division of the super-power zone engineering staff, was graduated from Cornell College, Mount Vernon, Iowa, with the degree of B. C. E. in 1888. In 1893 he received the degree of C. E. Upon graduation he entered the employ of the San Antonio (Tex.) Light & Power Company, where he remained for one and one-half years. Mr. Imlay supervised the installation and operation of the first 10,000-volt long-distance transmission line in the United States, near Pomona, Cal. He spent eight years with the Westinghouse Electric & Manufacturing Company, this experience including testing, experimental and construction work. He also spent several months as assistant to the superintendent of construction of the Westinghouse company. In 1902 he entered the employ of the Niagara Falls Power Company and served as superintendent of that company and the Canadian Niagara Power Company until they were consolidated in 1918 with the Hydraulic Power Company of Niagara Falls to form the present Niagara Falls Power Company. In the new organization Mr. Imlay was appointed operating engineer, the position be now holds.

L. E. IMLAY

W. Jocelyn E. Dale, electrical and mechanical engineer, formerly of the Matahambre Copper Mine, Pinar del Rio, Cuba, and recently electrical engineer for the Elia Sugar Company, has been engaged by Antonio Perez, S. en C., as electrical engineer and will be stationed at his sugar mill, "Central Cespedes," Cespedes, Camaguey, Cuba, where he will take charge of the electrical machinery that is being installed this year. Mr. Dale for the past two years has been actively engaged in electrifications of sugar mills.

J. B. McCall, president of the Philadelphia Electric Company, has been appointed a member of the advisory board of the super-power zone engineering staff, representing the National Electric Light Association.

Gen. Harry Taylor of the Corps of Engineers of the army, who has just been raised to the rank of brigadier general to be assistant to the Chief of Engineers, has played a large part in the development of the use of the searchlamp for military purposes. He first developed it for use in connection with seacoast defences. The generating sets used to operate those searchlamps, developed fifteen years ago, are still the standard used in the army and give good satisfaction. They are 25-kw. sets and occupy very small space.

O. N. Wiswell, superintendent of the Snoqualmie plant of the Puget Sound Power & Light Company, Seattle, Wash., has resigned. Mr. Wiswell entered the employ of the Puget Sound company in April, 1900. He served in different capacities until June, 1905, when he was appointed superintendent in charge of the Snoqualmie district.

George J. Walton, for nine years manager of the Klamath division of the California-Oregon Power Company at Klamath Falls, Ore., has resigned and will engage in private business. Mr. Walton has been connected with the company in various capacities since 1906.

N. J. Tubbs of the United States Geological Survey is en route to the West to take personal charge of the classification of lands in Montana, Idaho, Oregon and Washington and to determine their value in connection with the development of water power.

H. J. Pettengill, formerly sales manager of the Woonsocket division of the Blackstone Valley Gas & Electric Company, has been appointed sales manager of the Blackstone Valley Gas & Electric Company, with headquarters in Pawtucket, R. I.

John H. Pardee, president of the J. G. White Management Corporation, New York, has been appointed to the advisory board of the super-power zone engineering staff, representing the American Electric Railway Association.

A. T. Hardin, vice-president of operation of the New York Central Railroad, has been appointed by W. S. Murray, head of the super-zone engineering staff, to the advisory board, representing the New York railroads.

C. V. Peeling, formerly manager of the Cornwall (Ont.) Street Railway, Light & Power Company, has become connected with the Palmetto Power & Light Company, Florence, S. C.

D. B. Rushmore, chief engineer of the power and mining department of the General Electric Company, has been elected vice-president of the American Welding Society.

H. W. Butler, who has been designated as industries division engineer of the super-power zone engineering staff, received his training as an electrical engineer at Cornell University, where he was graduated in 1900. Mr. Butler was born in New York City in 1877. His early education was obtained in the public schools of that city. Following his graduation from Cornell he was employed with the Interborough Rapid Transit Company, where he served seven years. He resigned to accept a position with J. G. White & Company, with whom he was engaged until 1913. Later he did consulting work in New York. At the outbreak of the war he entered the army and was assigned to aircraft production. Since the armistice Mr. Butler has been acting as engineer for a superheater concern.

H. W. BUTLER

Obituary

George A. Woolley, district manager of the General Electric Company, with headquarters at Denver, Col., died from the effects of a stroke of apoplexy, July 4, at his summer home at Evergreen, near Denver. Mr. Woolley had been in the service of the General Electric Company for more than thirty years, for the past nine years district manager.

Frank Taylor, a founder and former president of the Taylor Instrument Companies of Rochester, N. Y., died there July 27, at the age of seventy-five years. In 1866, with H. F. Richardson, he started the business of making thermometers.

E. H. Murdock of Cincinnati, reputed to be the father of daylight saving in America, died in Baltimore on July 23. He was fifty-eight years old.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Universal Key Simplifies Outlet Box and Cover Matching

FOLLOWING the approval by the Outlet-Box Section of the Associated Manufacturers of Electrical Supplies of the standardized system of numbering outlet boxes and covers, as noted in these columns on Sept. 27, 1919, the Sprague Electric Works has not only applied to its products this system of numbering, but also has developed a key for use in connection with the devices, outlet boxes and covers of other manufacturers. The company has called it "the universal key—a quick cross-reference for matching any standard wiring device to any desired box and cover." A copyright protects this name and the design.

The "universal key" consists of a folding cover enclosing a seventy-page booklet. There is reproduced herewith, merely for purposes of illustration, a part of the inside of the first cover, sufficient of the second cover to show the names of some of the fifteen manufacturers of wiring devices listed thereon and a part of page forty of the booklet. This comprises the left half of the complete key when opened out.

In the first column of the left-hand cover will be found the new catalog numbers of the 4 1/16-in. square and 4-in. square outlet boxes and covers; in the second column the new catalog numbers of the 4-in. octagonal boxes and covers. The right-hand cover leaf, not reproduced here, shows the new catalog numbers of the 3 1/4-in. octagon boxes and covers and the new-type shallow and deep device conduit bodies and covers for exposed conduit wiring.

A contractor, having decided to use the General Electric Company's device, catalog number 9184, but not knowing what box or cover will best go with it, or a jobber, not carrying G. E. outlet boxes or covers, wishing to match up those of other makes to fit G. E. device No. 9184, will first turn to the catalog page listing the G. E. device number in its left column. In the middle column, under the heading "Boxes," will be found six symbols, each of which refers to an outlet box which will fit the specified device. The symbol 2A, by reference to the left-hand flyleaf, refers to a 4-in.-square box, new catalog number 51151; symbol 3A refers to a 4-in. octagon box of two different depths, etc. Covers to fit are taken from the symbols in the right-hand catalog column marked "Covers"—2D referring to cover with new catalog number 52C28, etc. If box 2A is used, cover 2D must be used, the cover numeral corresponding to that of the box. Cover number carries letter "C."

Thus in time, when, as it is expected, all manufacturers' catalog numbers will be identical, it will be very simple to match up devices, boxes and covers of various makes. Until that time, if it be desired to use a box or cover of a manufacturer not employing the new numbering, sufficient description is given in the key from the symbol to enable the product to be picked out from the dimensions.

Decrease in catalog space, the elimination of manufacturers' private numbers, reduction in variety of jobbers' stocks and great time and labor saving are expected to result from the use of this key with the standardization of catalog numbers. The new numbers have been made on so flexible a system that new boxes and covers may be added to the list without difficulty.

Cat. No.	4-11/16" Square		Cat. No.	4" Octagon	
72151	1½" Deep	1A	54151	1½" Deep	3A
72171	2¼" Deep	1A	54171	2¼" Deep	3A
72C3	Canopy 2¾" S.C.	1C	54155	1½" Deep	3A
72C39	Fluted Catch	1J	55151	Ext. Ring 1½" Deep	3A
	4" Square		55171	Ext. Ring 2¼" Deep	3A
51151	Comb. Gas Pipe & Str. Elec. 1½" Deep	2A	56111	½" Deep	3B
53151	Ext. Ring 1½" Deep	2A	56115	½" Deep	3B
51C5	Canopy 2¾" S.C.	2C	56121	¾" Deep	3B
52C3	Canopy 2¾" S.C.	2C	56125	¾" Deep	3B

Sprague	1-10&65-72
Arrow Elec.	12-22
Benjamin	22
Bryant	23-33
Chelton	33
C-H	34
Diamond H	34-35

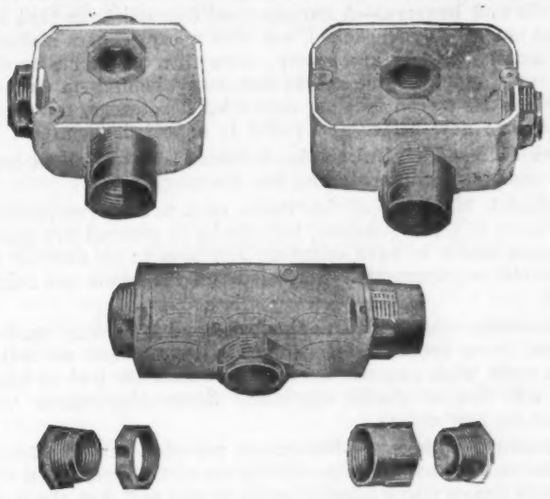
GENERAL ELECTRIC CO.

Cat. No.	Boxes	Covers
9184	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
9185	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
28856	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
33559	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
36817	2A-6A	2K-6O
39236	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
39237	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
40496	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
49355	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50717	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50745	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50746	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50753	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50755	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50786	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50797	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50798	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59807	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59873	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59874	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59875	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60018	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60019	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60020	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60124	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60294	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60295	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60296	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60447	2A-3A-3B-4A-4B-5A	2D-3D-3M-4D-5D
60448	2A-3A-3B-4A-4B-5A	2D-3D-3M-4D-5D

THE UNIVERSAL KEY—A QUICK CROSS-REFERENCE FOR MATCHING ANY STANDARD WIRING DEVICE TO ANY DESIRED BOX AND COVER

New Conduit Bodies Expected to Simplify Exposed Wiring

FROM time to time attempts have been made to introduce the advantages of knockouts into conduit bodies and thus gain the wide range of flexibility possessed by outlet boxes. This had proved impracticable of accomplishment up to the time of the war, largely because engineers were not driven to standardize. Since the war, however, and its accompanying era of standardization, four representative outlet-box manufacturers have brought out a line of pressed-steel conduit bodies with knockouts—a line so highly standardized that virtually the whole range of exposed conduit wiring requirements for ½-in. and ¾-in. conduit is compassed with but three basic bodies and two connectors, which when combined in any form desired result in a conduit body.



THREE CONDUIT BODIES AND TWO CONNECTORS FOR EXPOSED CONDUIT WIRING

This new line is being exploited independently by the Sprague Electric Works, which has adopted the trade name of "Spraguelets"; Thomas & Betts, who are calling their line "T & B Conduit Bodies"; the Pratt-Chuck Company, which names its product "Pratt Conduit Bodies," and the Steel City Electric Company, which has adopted the trade name of "Wirelets."

To meet the requirements of exposed wiring, a conduit body must be rigidly connected to the conduit without support. The connector affords just such a rigid arrangement, according to the statement of the manufacturers. The two connectors, employing the Chase nipple features, one designed for ½-in. conduit and the other for ¾-in. conduit, both fit the one size of knockout used in all the three bodies.

Adaptability to virtually any standard make of wiring device is one of the main features of these conduit bodies. To the long body, or "branch" body, with inside dimensions 3¾ in. long, 1¼ in. wide and 1⅞ in. deep, with eleven knockouts, are applied sixteen covers; to the "shallow" body, 2¾ in. long, 2¼ in. wide and 1⅞ in. deep, with five knockouts, are fitted twenty-four covers, while to the "deep" body, 3¼ in. long, 2¼ in. wide and 1⅞ in. deep, with five knockouts, there are fifteen covers. Thus with three bodies, two connectors and fifty-five covers, there are few standard exposed wiring device jobs which cannot be handled.

It is expected that these conduit bodies will effect economies through low stock investment for a complete line, with a corresponding reduction in shelf space; through saving in time of wiremen, who can almost instantly adapt a conduit body to virtually any standard condition, and through their ready reception of any standard make of wiring devices, thus eliminating the necessity of duplicating stock investments.

As the head of the connector nipple is octagonal, eight positions of the body in 360 deg. are permitted; a body at will becomes either a right-hand or a left-hand body, as desired; a body can be removed from or inserted into a conduit at will, without destroying the existing system, except for wire splicing; additional circuits can be added later, up to the limit of the knockouts in each body, and regardless of the thread length on the conduit, the system remains rigid and solid as the securing of the bodies is accomplished by tightening the conduit nut, after the conduit has been screwed into the conduit nipple.

Each body has been equipped with two or four ½-inch knockouts in the bottom in order to make the bodies as universal as possible, where it may be desired to use a support.

A unit package consists of ten pieces, and a standard package consists of ten unit packages. For the bodies and for the couplings a standard package consists of 100 identical units, while in a standard package of covers unit packages may be combined. Electro-galvanized finish only is applied to bodies, couplings and some covers, while other specified covers are of porcelain. According to present figures, it will cost a jobber approximately $600 to lay in a stock of one standard package of each item.

With the substitution of one piece of the two-piece connector, the conduit bodies may be adapted to wiring with flexible armored conductor.

In view of the fact that statistics show that about 85 per cent of the exposed wiring jobs done in the United States use ½-in. and ¾-in. conduit, it is felt that the manufacture of larger size bodies would not be justified at this time. At the same time it is expected that other manufacturers will enter this field of pressed-steel conduit bodies with knockouts.

Metal Market Situation

BUSINESS in copper during the past week has been decidedly dull, although the tone of the market seems firm. Producers are holding for 19 cents through the third quarter, but 19.25 cents is quoted for deliveries later than September. Purchases beyond October are not encouraged, even at 19.25 cents, because of uncertainties as to prices.

The outside market is shading prices from 25 to 50 points with sales rather quiet. The 40 per cent increase in freight rates effective on August 26 will, it is expected, increase the cost of copper about a cent a pound, and as a result of this a stimulation in the demand for early shipment is anticipated in order to take advantage of present prices. Labor conditions in the brass works of the Connecticut Valley are improving, and with production increasing in the district a heavy buying movement is looked for from that quarter.

Lead producers are generally sold up through August, and, although the market is firm, little activity is evidenced as buyers for later delivery are holding off. There is practically no market in either tin or zinc, quoted prices being merely nominal.

There is a very light market at present in tin, and while zinc is also quiet the tone is firm, with prices only nominal. The evidence of strength is the outgrowth of rumors of impending labor troubles together with the usual summer labor drift away from the smelters to the harvest fields.

NEW YORK METAL MARKET PRICES

	July 27	August 3
Copper	£ s d	£ s d
London, standard spot	92 0 0	92 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18.62½	18.62½
Electrolytic	19.00	19.00
Casting	18.00	18.00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	8.50
Antimony	7.25	7.25
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.10	8.02½
Tin	48.75	48.25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.25 to 9.50	9.25 to 9.50
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	7.25 to 7.50	7.25 to 7.50
Zinc, old scrap	5.00 to 5.50	5.50 to 5.75

THE WEEK
IN TRADE

ALTHOUGH the market for electrical material has been rather quiet all over the country as compared with past weeks, in no section are sales alarmingly low. In the East, in the South, in the Middle West and in the Northwest a good volume of sales is reported for this time of year, while Seattle seems to be experiencing an isolated slump, and trade in the Intermountain States is suffering from a dearth of construction work.

Collections appear to be uniformly tightening throughout the country, with more effort being required in obtaining payment of bills. A favorable factor in the situation, however, is that all districts but one report satisfactory underlying business conditions and express the opinion that the credit situation gives no cause for alarm. The one exception is in the Intermountain section, where a condition bordering upon business depression exists, but even here the peak of the trouble seems to be past and a good crop outlook gives rise to optimism.

The transportation situation improves spasmodically, with better deliveries ruling in the East and Middle West, but in Southern territory the car shortage is seriously interfering with building construction work, and in the Northwest a car supply about 60 per cent under normal has tied up grain shipments.

Light stocks and poor prospects for obtaining supplies of heating appliances are giving rise to fears for a shortage in the East, but supplies west of the Mississippi seem to be in fairly good shape with lessened demand. Fan sales are still off except in the Intermountain section.

NEW YORK

The local market for electrical goods has been a little quiet the past week, jobbers report, but in spite of lighter sales the volume of business is considered favorable.

Residential construction work is decidedly off, probably because of prevailing high prices of building materials, and consequently the demand for electrical material is shifting to industrial requirements. As a result of the few houses being built, the situation for most of the wiring materials is easing up and fair stocks are now accumulating. Another factor aiding this circumstance is the continued improvement of transportation which has allowed shelves long bare of stocks to be replenished. Although few new houses are being erected, construction for industrial and business purposes continues with no letup. During the past week several large real estate deals have been put through in uptown districts preparatory to commencing building operations, and plans which will eventually make New York the finest port in the world have just been approved for the construction of eighteen mammoth piers, replacing thirty-two antiquated structures in the North River.

The general tone of the electrical industry as to future business prospects in this section would seem to be optimistic. Collections are tighter if anything, but the credit outlook, as expressed recently by the Comptroller of the Currency and by the governor of the Federal Reserve Board, is favorable and gives no cause for uneasiness.

Rigid Conduit.—Demand is very heavy and stocks are generally bare. The shortage continues, but here and there a slight rift appears, with one jobber reporting a little easier demand, while another has just accumulated a good stock through recent shipments. Quotations for ½-in. white are about $90 to $100 per 1,000 ft.

Flexible Armored Conductor.—The situation is quite a bit easier, with lessened demand and better shipments, allowing fair stocks to accumulate. Prices for No. 14 in 1,000-ft. lots range from $104 to $110.

No. 14 Rubber-Covered Wire.—Good stocks seem to be the rule, with a lessened demand in evidence. Shipments are coming through nicely. Prices average around $11.50 per 1,000 ft.

Non-Metallic Flexible Conduit.—Demand seems to have fallen off, with the result that no shortage is felt. The ⅜-in. size is quoted at from $33 to $36, and the ½-in. from $36 to $39 per 1,000 ft.

Fans.—Some jobbers report they will have to carry over stocks, while others consider themselves lucky in expecting just about to sell out supplies on hand. All agree that sales have been very disappointing.

Bells and Buzzers.—A curious condition exists in that demand has greatly slackened, yet with many jobbers a shortage exists. Stocks are spotty. One firm is unable to obtain any supplies and others are away behind on orders. This can be traced to slow deliveries heretofore, but shipments are now better and relief is expected soon.

Dry Cells.—Plentiful stocks, a demand that is about normal and good shipments feature the market.

Schedule Material.—A few items, such as flush receptacles, are short in some quarters, but stocks in general are good. Demand seems to have eased up and also to be shifting to industrial requirements. Shipments on the whole are fairly good.

Porcelain.—Some jobbers think demand is holding up, but several have found it slackening. Nevertheless, no relief is in sight with shipments of this material as bad as they are, and famine stocks continue. Some distributers will accept no new orders.

Heating Appliances.—Stocks are reported very light and a normal demand exists for this time of the year. An extremely heavy trade is anticipated in the fall, but the consensus of opinion is that a serious shortage will result. Shipments are poor; one jobber has received no hollow-ware for six months, and some firms will take no further orders now.

BOSTON

Trade is somewhat spotty this week, some jobbers reporting continued heavy orders and others noting a decided slackening in demand. Stocks are being liquidated, however, wherever possible, and purchasing is being handled by wholesalers on a very conservative basis. One large house had $100,000 in overstock the first of the week and has cut buying to its estimated needs two months hence. A leading jobber reports the largest July trade in his history, while another representative house has cleaned up most of his back orders and is pursuing a waiting policy. Deliveries are much improved except on small motors, hollow ware and porcelain fittings. Collections are being pushed more sharply. Labor is quieter than for some time. Building and engineering contracts for the last two weeks of July in New England fell off from $12,486,000 last year to $11,916,000 in 1920. Prices stiffened last week in fiber conduit, "Square D" safety switches and Simplex ranges. Apart from occasional cut-price sales of irons, portable lamps, flashlights, etc., prices hold firm on electrical goods and supplies. Contractor-dealers are extremely busy on factory work, but little house wiring is being done.

Many contractors have been so busy that their invoices have been neglected, and jobbers have suffered accordingly from the curtailment of actual remittances. The underlying situation appears sound enough, but closer attention to collections is a vitally important matter in smooth business operation.

Fans.—Continued humid weather has reduced stocks to small totals,

Lamps.—Low-voltage lamps for farm-lighting sets are reported short. It is very hard to accumulate any real stocks of lamps in regular sizes.

Motors.—Reports continue of cleaned-out stocks of small motors. One purchaser of a 1-hp. direct-current motor visited twelve jobbers last week before success was attained, and this unit was the last the house had.

Wire.—Good stocks are on hand and production is once

more meeting current requirements. Rubber-covered No. 14 sells at $11 per 1,000 ft. in 5,000-ft. lots, weatherproof No. 6 at $31 per 100 lb. in 200-lb. lots, and bare on a 23-cent to 24-cent base.

Ranges.—Simplex ranges were increased in price July 26. No. 27 is now quoted at $190 list instead of $175, with 25 per cent off to small dealers.

Rigid Conduit.—Fair stocks are now in hand. Jobbing prices are as follows, less 5 per cent for cash on these sizes: ½-in. galvanized, $99.58 per 1,000 ft. in less than 2,500-lb. lots; black, $93.98. In such lots the ¾-in. size brought $132.20 in galvanized and $124.60 in black. Galvanized 1-in. pipe sold at $195.42 per 1,000 ft. in less than 2,500-lb. lots, and the 1-in. black pipe brought $184.20.

Couplings.—Price on ½-in. couplings is $8.66 per 100, less 5 per cent off for cash, $12.37 being charged for ¾-in. and $16.10 for 1-in. fittings, with the above discount. Stocks are reasonably good.

Schedule Material.—Severe shortages are reported in porcelain sockets, switches and fittings, although tubes and knobs are in fair stock. Sockets are plentiful, and there is no change from recent quotations of 50 cents net on pulls, 28 cents on keys and 26 cents on keyless, in case lots.

Flexible Armored Conductor.—Current demands are being well met, No. 14 single-strip being quoted at $110 per 1,000 ft. in 1,000-ft. lots.

Non-Metallic Flexible Conduit.—Good stocks are on hand, with steady prices. The ⅜-in. size brings $33.50 per 1,000 ft., and the ½-in. size $36.50, in 5,000-ft. and 1,000-ft. lots respectively.

Fiber Conduit.—Prices were advanced about 15 per cent last week, owing to raw-material shortages, transportation difficulties and labor costs. The demand is active, but freight embargoes are burdensome. Eight to ten weeks' delivery is quoted on fair-sized orders.

Paper-Insulated Cables.—The demand is extremely heavy. In a representative case cable manufacturers are paying 30 cents a pound for paper and have recently increased their demand from 250 tons to 500 tons a month.

CHICAGO

The financial situation has recently showed marked improvement, due partly to an improvement in the transportation situation and partly to the fact that all branches of the electrical industry are becoming accustomed to doing business under delayed traffic conditions and are finding ways to adjust their finances to the new order. Many concerns, formerly consistent discounters of bills, have this spring been forced to take sixty and even ninety days for payment. They are gradually reducing this time, some having recently resumed discounting and others indicating that they will soon be able to do so.

As a whole, business remains good, but a noticeable falling off is noted in household appliances. This also has been largely influenced by financial conditions, as difficulty has been experienced in financing extended payments. It is stated that this condition is improving and increased selling will probably develop at an early date. Certain industrial centers which have experienced wholesale lay-offs of workmen have been unable to absorb their allotment of this class of material. It is thought that an adjustment of the fuel situation will probably correct this.

Motors.—Business is practically as good as ever, with deliveries still ranging from three months to a year on large sizes. The General Electric Company has announced a 15 per cent increase on synchronous motors and generators, both alternating and direct current. Some makers of fractional-horsepower motors are having difficulty in finding an outlet for their production.

Compensators.—Great difficulty is being experienced in obtaining sufficient units to supply demand, motors being frequently shipped with compensators to follow. Deliveries range from sixty days up, with definite promises hard to obtain.

Transformers.—No change either in prices or in supply has been noted recently. Stations transformers are slow in delivery, and the pressure of new orders is sufficient to maintain this condition for some time to come.

Oil Switches.—Motor-driven types are obtainable in from thirty to sixty days, but panel types are harder to get. There are almost none in local stocks, and from four to five months is required fer delivery from factory. Prices show no indications of immediate change.

Porcelain.—Badly broken stocks and seriously retarded deliveries are the rule. No price changes have been made effective, but manufacturers are careful to state that current quotations on knobs, tubes and cleats are not guaranteed.

Receptacles.—All quotations are withdrawn, orders being booked with no promise as to delivery and at the price ruling at time of shipment. Particular difficulty is experienced in obtaining electric sign receptacles.

Heating Appliances.—Retail sales are noticeably light, and this is largely attributed to the backward season, though prevailing high prices may be having a deterrent effect. Jobbers' stocks are getting in better shape, and retailers are able to supply all requirements.

Washing Machines.—The financial situation has caused a reduction in the volume of sales, but improved conditions with manufacturers and jobbers should cause an immediate improvement. Chicago sales continue good, must of the slackening of sales being noted in surrounding towns.

ATLANTA

Apparently there is a strengthening of the public's determination to hold off purchasing until prices show a greater decline than has been realized to date. Retailers are placing orders with a great deal of care and feel sure that a decline is sure to come, though this conclusion is not concurred in by the wholesale trade. The holding off in placing orders is particularly noticeable in rural districts where most of the business done is with the smaller houses.

Activity in electrical supplies in Atlanta continues very brisk, however, stimulated by the enormous building activities throughout the city. The month of June saw a new high total of building permits reached, and this construction is just getting under way. July permits show a decline as compared with the preceding month. General conditions are reported excellent in Florida, where the fruit and citrus outlook is very bright, and pig iron in the Birmingham district shows an increase in production of approximately 250,000 tons over the same period of last year.

Car shortage is causing difficulty both in this district and in lumber production centers and is interfering seriously with building operations. Lumber prices have settled to a basis approximately 10 per cent to 15 per cent under the quotations of thirty days ago. Money continues tight and collections are reported not altogether satisfactory.

Heating Appliances.—The situation is not at all satisfactory, shipments coming through very slowly and practically all being applied on back orders, thus preventing any stocks accumulating for the holiday trade. A price advance of approximately 15 per cent is to be noted on irons, percolators and certain types of heaters.

Wire.—Stocks are only in fair shape, despite the receipt this week of a car of assorted sizes which was entirely absorbed by back orders. The popular and very large sizes are particularly unsatisfactory, shipments on 500,000-circ.mil and over and varnished-cambric cable running anywhere from seven to thirteen weeks in the face of a very urgent demand.

Electrical Toys.—Jobbers report an awakening activity, and shipments to dealers are beginning to move. This is the result of instructions to jobbers' salesmen to push the trade during the summer months.

Stamped-Steel Boxes.—Outlets and service boxes are short, with shipments quite unsatisfactory. The demand is brisk, with little prospect of it slackening until building activities ease off.

Sewing Machines.—A slump is reported in their movement and very few orders are being received. Prices remain steady and good stocks are reported on hand.

Electric Ranges.—Local demand is reported as having picked up considerably in the past few weeks, being stimulated by the high price of fuel. The receipt of a considerable shipment by one of the large jobbers has assisted in meeting this demand, and local stocks in some sizes are in fair shape. Shipments, however, are very slow and unsatisfactory.

Schedule Material.—Prices have been withdrawn and jobbers are quoting prices only on such material as they happen to have in stock. Supplies are rather spotty and in some lines very unsatisfactory. Stocks of push-button switches are exhausted and shipments are coming through very slowly.

Porcelain.—Porcelain continues very scarce, despite the receipt of a car of assorted knobs, cleats and tubes last week, and no ⅞-in x 3-in tubes are on the market, with little prospect of shipments coming through in the near future. Back orders immediately absorb all supplies received.

SAN FRANCISCO

Trainload shipments of fruit are now on their way East, and during the height of this season the canneries are in their busiest period. Jobbers have just concluded their quarterly convention at Del Monte. The soliciting salesmen of all the jobbers have just returned from their annual vacation. This is the third season that a simultaneous vacation has been set for all soliciting salesmen, and the plan has been so successful that it will be continued indefinitely.

Vacuum Cleaners.—These are the best selling household device and stocks of all makes are reported excellent. A considerable portion of the sales is being made on the time-payment basis to customers who a few months ago requested cash prices and are still able to pay them but are now retrenching.

Insulating Material.—Local stocks of tapes, cloths and insulating compounds are good. Demand is fair and steady.

Water Heaters.—Local stocks are better than they have been for many months with most of the call in favor of the 4-kw. and 5-kw. sizes. Summer resorts have offered a particularly good field this season, with local makes getting the call and quick delivery the rule.

SEATTLE—PORTLAND

Business along electrical lines in the Pacific Northwest, with the exception of Seattle, is well sustained and on the whole quite satisfactory. In Seattle sales along all lines, from appliances to heavy power apparatus, are showing decreases. Towns in the Puget Sound district report that sales are holding up well and are even showing increases on schedule materials, household appliances, farm-lighting plants, storage batteries and automobile lamps. The situation in Seattle is attributed to the general feeling of uncertainty which prevails, to the employment situation and the scarcity of new construction.

Stocks in nearly all cases are in excellent condition, and on such items as farm-lighting plants, lamps, domestic appliances and fixtures there is a surplus. Seattle and Tacoma are considerably exercised over the recent action of the United States Shipping Board in releasing for the market an enormous amount of electrical material purchased during the war period and held since the armistice. It is believed that this flooding of the market will cause a depression until the materials have been absorbed.

Collections in the Seattle district during the month of July were excellent. Cities in the Puget Sound section report that collections vary from fair to good. Credits are being extended sparingly at present, with prospective accounts asked to pay cash. The car shortage has already partially tied up early movements of grain and other crops from this district. Present indications are that there will be no substantial relief for the next few months. The present car supply is estimated at between 60 and 65 per cent below normal. Plans for two passenger steamships to be operated between Seattle, San Francisco and Los Angeles, each costing approximately $4,000,000, have been approved by officials of the Pacific Steamship Company and bids are expected to be called for shortly.

Conduit.—Sales during the past two weeks have increased materially, the major portion being used in reconstruction work. Demand far exceeds available supply.

Storage Batteries.—In Seattle sales are showing a gradual decrease, owing to inactivity in automobiles. This decrease in the sales of automobiles is attributed to tightening credit and the gasoline situation, which is not expected to improve before September.

Farm Plants.—Jobbers in Seattle, Portland, Tacoma and Spokane have no stocks. Demand, it is predicted, will be heavy later in the season. Sales are expected to be light until crops have been moved. Prices have not increased, but a rise would not be surprising.

SALT LAKE CITY—DENVER

Inactivity in all kinds of building and construction work in Denver has caused a noticeable slump in the sale of electrical equipment for new installations. The controversy between trade unions and employers adhering to the "American plan" has brought building to a standstill in many sections. The deadlock in some sections has held out for weeks, but there are indications that the worst of the trouble is past and that construction work will soon be back to normal.

Transportation is irregular and uncertain. Jobbers complain of being unable to get shipments in time to meet demands made on them. In lines where demand has fallen off stocks are ample, but where sales are brisk shortages are noted. The money stringency has brought about a condition that verges on business depression. Bankers are hopeful, however, that the peak of the trouble is past. The outlook for heavy crop yields is good, particularly in irrigated regions.

Schedule Material.—Demand is not at all brisk, and as a result there is an accumulation of stocks in some quarters. The sluggish condition of the market is attributed to the general slump in building lines.

Fans.—A lively trade in fans is reported from many retail centers, and jobbers report a good volume of sales. Vigorous advertising campaigns appealing to households, have brought satisfactory returns. A month of dry, sweltering weather has made the appeal opportune.

Household Appliances.—There has recently been a noticeable falling off in demand for vacuum cleaners and washers. Sharp advances in prices are believed to account for this. The present level of prices makes buying prohibitive to the average householder and the inability of bankers to cooperate with dealers in a way that makes possible the handling of time sales further aggravates this condition.

Heating Appliances.—Demand is holding up to something like normal. Stocks are fairly ample with occasional complaints of irregular shipments.

Street-Lighting Installations.—An unusual interest in street lighting is being manifested by intermountain municipalies. Many new installations are reported from both large and small towns.

Porcelain.—The condition of scarcity continues here. Demand is not excessively heavy, but the available supply is abnormally low.

Lamps.—These are not showing any tendency to move. This is to be expected as a sluggish market is characteristic of the summer season. Dealers are stocking for the fall and winter trade.

Rigid Conduit.—Stocks are scarce and jobbers cannot begin to meet the demand.

Pole Line Material.—Construction work in many sections is responsible for a brisk demand for line materials. A mammoth transmission line from the Thousand Springs plant to Caldwell, Idaho, carrying 132,000 volts is now in course of construction and this has created a special demand for all kinds of pole line material and equipment.

Wire.—Many jobbers are short because of eastern factories closing down.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Electric Glue Pot

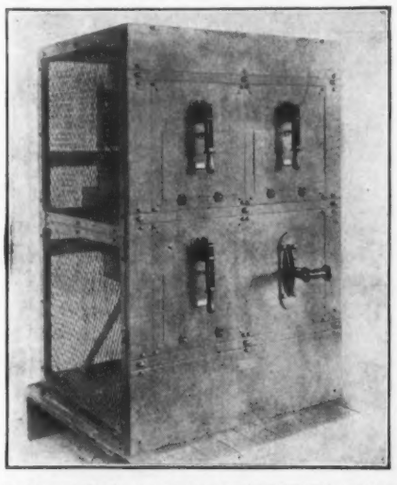
A two-quart dry-type glue pot, the glue vessel of copper, is being sold by the Westinghouse Electric & Manufacturing Company. The single-heat constant-input heater is said to give the correct working temperature to the glue for continuous operation of the dry-type glue pot.

WATER BATH ELIMINATED

Panel for High-Speed Motors

Two types of floor-mounted panels have been developed by the General Electric Company to operate and control the new high-speed motors and generators, of frequencies higher than 60 cycles, just brought out by that company. The dead-front type contains a safety-first switch and fuses for both incoming power lines and outgoing high-frequency lines, an oil switch with undervoltage protection for the electrical and excitation power circuit and a starting device for the driving motors. These panels are so constructed as to furnish protection from accidental contact with live circuits.

The second type is less elaborate but contains everything necessary to efficient control. It has three fuses for the high-frequency lines and a contactor to connect the stator to the lines automatically after the driving motor has started. It is further equipped with a hand starting device mounted on the pipe supports below the panels.



DEAD FRONT AFFORDS PROTECTION FROM ACCIDENTAL CONTACT

Automatic Electric Range

Easy and quick-servicing is the manufacturer's designation of the feature of the new range, type M-1, placed on the market by the Westinghouse Electric & Manufacturing Company. Advantages claimed for it are easily removable burners of the open-coil type, removable platform for accessibility to connections, separate fuse boxes and interchangable oven and platform. The oven and broiler burner has a capacity of 2,000 watts, while of the four 8-in. stove-top burners two are of 1,500 watts and two of 1,000 watts. Full automatic, half-automatic or non-automatic equipment may be furnished.

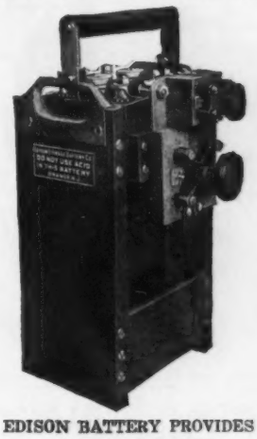
DOOR HINGES CARRY AUTOMATIC CONTROL

Portable Electric Dish Washer

A new electric dishwashing machine of the Jewel Electric & Manufacturing Company, 1833 Berteau Avenue, Chicago, is now on the market, designed for domestic use. Weighing about 35 lb., the machine is portable and provided with a spun automatic ventilated top fitted with a round glass cover. It is said to be self-cleaning. Other features of the machine are the method of throwing the water upward by means of a patented two-blade dasher and the method of draining the water. A Universal motor drives the vertical shaft through a rubber belt.

Meter-Loading Rheostat

A portable means of loading direct-current meters for test that is said to be rugged, compact, convenient and safe is being put out by the Standard Scientific Company, 147 Waverley Place, New York City. This company supplies the carbon rheostat and other apparatus in connection with the Edison storage battery, the sets being termed the Allen meter-loading rheostats. They come in five types.



EDISON BATTERY PROVIDES LOADING CURRENT

Radiophone

The OT-5 radiophone, which operates without "B" battery or external source of high potential, has been developed by the De Forest Radio Telephone & Telegraph Company, 1415 Sedgwick Avenue, New York City. The entire output may be easily transported; the transmitter weight is 60 lb., including two 6-volt storage batteries. It operates with any suitable type of receiver and audion detector, the manufacturer says, with or without an audion amplifier, depending on range, loudness, etc. The set is designed to operate an antenna whose capacity to earth varies from 0.002 mf. to 0.0007 mf., although it may be used on even smaller antennas.

SET OPERATES ON TWO SIX-VOLT STORAGE BATTERIES

Electric Clothes Washer

The new Thor No. 32 galvanized washer of ten-sheet capacity is being marketed by the Hurley Machine Company, Chicago. The all-metal sheet-

OCCUPIES RELATIVELY SMALL FLOOR SPACE

steel body is equipped with an 11-in. ball-bearing swinging wringer and can be furnished in either wood or copper cylinder. It also comes in copper body with wood or copper cylinder. The copper body is tinned on the inside and enameled on the outside. A ½-hp. motor drives the eight-revolution reversing cylinder. Floor space of the ten-sheet size is 25 in. x 38 in.; of the six-sheet size, 25 in. x 33 in.

Advertising Projector

The Automatic Balopticon, a product of the Bausch & Lomb Optical Company, marketed by the Automatic

AUTOMATIC OR MANUAL PICTURE PROJECTOR

Illuminated Advertising Corporation, Baltimore, Md., is an illuminated advertising projector, operating automatically and continuously, intermittently showing sixty-eight slides of any desired picture or reading matter. These are shown on a screen 20 in. x 20 in. and change every ten seconds. By using a push-button and cord control pictures may be changed at will by a speaker when used for lecture purposes; in this case a 10-ft. x 10-ft. picture may be projected.

Electro Dental Atomizer and Water Heater

A newly designed combination heater having separate regulation for the water glass heater and the three atomizer heater cups is a product of the Electro-Dental Manufacturing Company, Philadelphia. The outfit includes the heater, one glass each for water heater and atomizer heater cup. The base of the heater is of onyx.

Mogul Condulets

To meet a demand for condulets having an unusually long cover opening and big wiring chamber, the Crouse-Hinds Company, Syracuse, N. Y., has developed for the market a new series of "mogul obround" condulets. These are made in eight types, each type in eight conduit sizes ranging from 1 in.

LONG COVER OPENING AND LARGE WIRING CHAMBER

to 4 in. Four sizes of composition and cast-iron covers are made, the composition covers finished blank with from one to nine holes, the iron cover finished with or without round rubber gasket.

Notes on Recent Appliances

Electric Washing Machine

An electric clothes-washing machine operating on the vacuum-cup principle has been developed by the Plex Vacuum Electric Washing Machine Company, Inc., Pekin, Ill.

Rheostats for Radio Use

The General Radio Company, Cambridge, Mass., has placed on the market a rheostat of small rating for laboratory and radio use.

Electric Bell

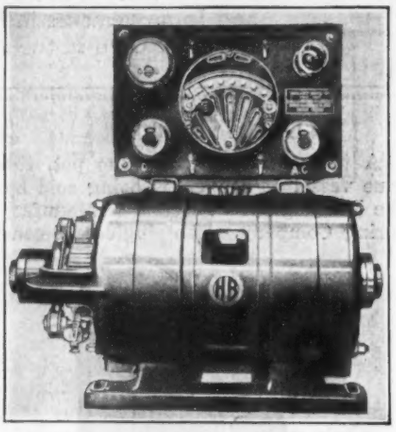
The Electrical Trading Company, 200 Broadway, New York City, has brought out an electric bell with operating mechanism under gong.

Electric Sterilizer

An electric sterilizer for soda-fountain use has been manufactured by the Holcomb & Hoke Manufacturing Company, Indanapolis, Ind.

Battery-Charging Outfit

A new ten-battery charging set of 600 watts rated capacity is being marketed by Hobart Brothers Company, Troy, Ohio. It is equipped with ball

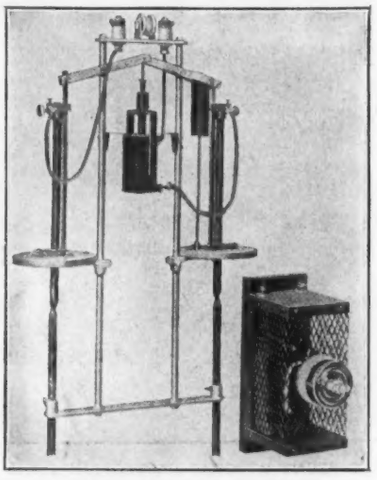


CHARGES 6, 12 OR 24-VOLT CELLS

bearings and the switchboard, with ammeter, pilot lamp, field rheostat, fuses and switches, is mounted on top of the set. The output is 10 amp., 6 volts to 70 volts; the weight is 300-lb. The set is made for floor or bench mounting only.

Photographic Arc Lamp

The Hi-Power twin-arc lamp is being manufactured by J. H. Wagenhorst & Co., Youngstown, Ohio. It is a white-flame arc and, according to the manufacturer, may be used for making blueprints, copper and zinc plate halftones, portrait proofs and copy work. The photographic and photo-engraving outfits consist of portable stands with lamp and reflector as one unit adjustable in a vertical line. Its over-all height is 8 ft. 6 in. and it is 28 in. wide. Either direct current or alternating current at 105 to 115 volts and 215 to



GIVES WHITE FLAME

225 volts may be used. A rheostat and control unit is made up as a separate part for installation at any convenient place.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE DUPLEX STORAGE BATTERY COMPANY, 537 Edison Street, Milwaukee, Wis., is planning to move its factory to Neillsville, Wis., about Oct. 1. The capital stock of the company will be increased from $60,000 to $250,000 to finance the construction and equipment of a new plant. A. G. Shedden of Neillsville is secretary and treasurer.

THE FORT WAYNE (IND.) BATTERY MANUFACTURING COMPANY has been reorganized under theh name of the Samson Manufacturing Company.

THE HERCULES ELECTRIC COMPANY, Indianapolis, Ind., manufacturer of electric machines and devices, has sold its plant to Charles G. McCutcheon, B. P. Remy and Frank Remy, builders of the Remy plant at Anderson, Ind.

THE AUTOMATIC LIGHT SWITCH COMPANY, 304 West Breckinridge Street, Louisville, Ky., recently organized to manufacture specialties and automatic switches for electrical service, is planning to erect a new plant in the near future. J. W. Roberts is president.

THE INDEPENDENT ELECTRIC MACHINERY COMPANY, Kansas City, Mo., announces that it is now established in its new building, located at the corner of Twentieth and Central Streets. This change was made necessary by the demand for more space in its factory, which will be accomplished by converting other properties into factory and warehouse space.

THE H. W. JOHNS-MANVILLE COMPANY, New York City, has started work on construction of the first unit of a plant at Waukegan, Ill., consisting of five buildings, each 250 ft. x 1,000 ft., to be followed by a second unit of the same proportions.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has been granted permits to erect two factory buildings, one 66 ft. x 59 ft. and the other 62 ft. x 141 ft., at Charles and Cromwell Streets, Baltimore, Md., to cost about $44,000.

THE COMMERCIAL RADIO COMPANY OF AMERICA, Providence, R. I., manufacturer of wireless equipment, has filed notice of increase in capital stock from $100,000 to $1,000,000.

THE GENERAL MOTORS CORPORATION, Detroit, Mich., has leased the plant of the Waukesha (Wis.) Malleable Iron Company for a period of five years. The company has reserved the right to purchase the property at the expiration of the lease.

THE STEEL CITY ELECTRIC COMPANY, Pittsburgh, Pa., has filed plans for the erection of a new plant, three stories, to cost about $30,000, at 1923 Columbus Avenue, Northside.

THE JAMES LEFFEL COMPANY, Springfield, Ohio, manufacturer of turbine waterwheels and stationary engines and boilers, is considering increasing its capital stock by $700,000, of which $400,000 will be in 8 per cent cumulative preferred and $300,000 in common stock. The company has recently completed its new manufacturing plant, containing 160,000 sq.ft. of floor space, and is now transferring the machinery from its old plant on Lagonda Avenue to the new building. The Robbins & Myers Company, manufacturer of electric fans, generators and motors, will occupy the old plant.

THE COLUMBIA X-RAY & ELECTRICAL CORPORATION, 131 East Twenty-third Street, New York City, has filed notice of increase in capital stock from $40,000 to $100,000.

THE EXIDE BATTERY DEPOTS, INC., 101 West End Avenue, New York City, has acquired a site at Spring and Clark Streets, 115 ft. x 125 ft., on which it proposes to erect a new two-story service building, to cost with equipment about $225,000.

THE BROWN INSTRUMENT COMPANY, Wayne and Windrim Streets, Philadelphia, is making arrangements for an extension to its plant, to cost about $20,000.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, 216 South Clinton Street, Chicago, has awarded contract for the erection of a plant, 80 ft. x 150 ft., five stories, at 925-37 Wrightwood Avenue, to cost about $250,000.

THE ARTHUR JONES ELECTRICAL COMPANY, 2837 South State Street, Chicago, has awarded contract for the construction of an automobile service station, 125 ft. x 125 ft., at 344 East Twenty-ninth Place, to cost about $62,000.

WILLIAM BURNS, Woodstock, Ill., manufacturer of storage batteries, has purchased the machine shop owned by E. G. Griebel on Main Street and will establish his plant there.

DELCO-LIGHT CONVENTION.—Sixty-five salesmen of the Delco Light Company, Dayton, Ohio, in Kentucky, southern Indiana and southern Illinois held a two-day convention in Louisville the middle of July. E. L. Uncapher, head of the E. L. Uncapher Company, agent in charge of this territory for the products of the Delco Light Company, acted as host to the convention.

MACBETH-EVANS CHANGES.—J. F. Humez has become domestic manager and H. L. Lissfelt export manager of the New York office of the Macbeth-Evans Glass Company, 19 West Forty-fourth Street. G. N. Lukens, formerly manager of the New York office, and J. W. Harvey, assistant manager, resigned about July 1 to enter the export business.

THE REPUBLIC FLOW METERS COMPANY, Chicago, announces removal from 565 Washington Boulevard to its new factory at 2240 Diversey Boulevard.

E. E. POTTER has become district sales manager of the New York office of the Edison Lamp Works 120 Broadway, to succeed R. G. Henderson, who becomes merchandising manager of the International General Electric Company, same address.

G. F. KIRKPATRICK, formerly manager of the appliance department of the Pacific States Electric Company, Seattle, Wash., has taken a similar position with the Electric Appliance Company, 1214 Third Avenue, Seattle.

THE FRANKLIN ELECTRIC COMPANY, Louisville, Ky., has filed notice of change in name to the Franklin Electric Company of Louisville.

Supply Jobbers' Notes

PHILIP J. BOHNE, formerly vice-president of the Lincoln Savings Bank & Trust Company, Louisville, Ky., has resigned to become secretary and treasurer of the E. L. Uncapher Company, jobbers of electrical supplies. The company has filed notice of increase in capital stock from $100,000 to $350,000.

Foreign Trade Notes

R. G. HENDERSON has become merchandising manager of the International General Electric Company at 120 Broadway, New York City.

INDUSTRIAL FAIR IN NORWAY.—An industrial fair will be held in Christiania, Norway, from Sept. 5 to Sept. 12, under the direction of the Norwegian Secretary of Commerce. The object of the fair is to promote the sale of Norwegian industrial, electrical and mechanical products. During the latter years this sale has had a very noticeable growth, particularly within the electrochemical and electrometallurgical industries, which has been very large. During the years 1909-1916 the exports of these industries have been doubled four times and the value has been doubled sixteen times.

Foreign Trade Opportunitic

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commission firm in Rumania (No. 33,293) desires to be placed in communication with manufacturers for the sale in that country of electrical supplies, etc.

A commercial agent in Brazil (No. 33,322) desires to secure agencies from manufacturers and exporters for the sale of electrical supplies, etc.

A commercial agent in Italy (No. 33,327) desires to represent firms for the sale of electrical goods, etc.

A merchant in Switzerland (No. 33,382) desires to secure an agency from the manufacturers for the sale of electric motors, electric tools, electric appliances and allied lines.

A merchant in Switzerland (No. 33,387) desires to secure an agency on a commission basis for the sale of electrical apparatus, etc.

Trade Publications

PIPE JOINT CLAMPS. — The Yarnell-Waring Company, Chestnut Hill, Philadelphia, has issued folder No. C-805, describing its "Yarway" pipe joint clamps and "Yarway Holtite" pipe clamps.

AIR SEPARATOR. — The Griscom-Russell Company, 90 West Street, New York City, has issued bulletin No. 1111, covering its Stratton air separator.

SAFETY APPARATUS.—The Canadian Krantz Electric & Manufacturing Company, Ltd., Toronto, Ont., Canada, has issued catalog 12-A, describing its safety apparatus for panelboards, switches, etc.

INDUSTRIAL HEATING APPARATUS. —The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing miniature catalog 9-A-2, which describes its industrial heating apparatus.

HEATING DEVICES. — "Satisfaction Guaranteed" is the title of the catalog recently issued by the Satisfaction Guaranteed Corporation, 651-55 Fulton Street, Chicago, which describes its electrical heating appliances.

TIME-SAVING ACCESSORIES.—In the latest issue of the "Esterline Graphic," published by the Esterline Company, Indianapolis, Ind., the subject of time-saving accesories for use with graphic meters is taken up.

ELECTRICALLY DRIVEN TOOLS.—The James Clark, Jr., Electric Company, Louisville, Ky., has issued catalog No. 28, covering the "Willey" electrically driven tools, generators and motors, etc.

PNEUMATIC POWER HAMMERS.—The Nazel Engineering & Machine Works, 4041-4045 North Fifth Street, Philadelphia, have issued a catalog covering their pneumatic power hammers for belt or direct motor drive.

FLEXIBLE SHAFTING. — The Stow Manufacturing Company, Binghamton, N. Y., has issued Bulletin No. 20, covering its flexible shafting for motor-driven tools.

New Incorporations

THE ADAIRVILLE (KY.) ELECTRIC COMPANY has been incorporated with a capital stock of $15,000 by G. H. Byars, G. A. Smith and I. G. Mason.

THE WHITE PLAINS (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by O. C. Littlepage and others.

THE WOOD COUNTY RURAL POWER & LIGHT COMPANY, Grand Rapids, Wis., has been incorporated with a capital stock of $100,000 to supply electricity in Pittsville, Vesper, Arpin, Milladore, Sherry Mills, Rudolph and Blenker. George Horn, J. C. Kieffer, Charles Corn and W. W. Clark are interested in the company.

New England States

FORT KENT, ME.—The Public Utilities Commission has authorized the Fort Kent Electric Company to increase its capital stock from $50,000 to $125,000 for the purpose of extending transmission lines through the towns of Frenchville, Madawaska and Grand Island to connect with the feed lines of the Gould Electric Company in Van Buren.

GREENE, ME. — Permission has been granted to the Central Maine Power Company of Augusta to extend its service to Greene for a street-lighting system.

CLAREMONT, N. H.—Plans are under way by the Vermont Hydro-Electric Corporation of Rutland, Vt., for the erection of a transmission line from Claremont, N. H., to Newport, Vt., thus enabling the furnishing of power to the Newport Electric Company as well as to Ludlow, Chester, Springfield and other towns in Vermont.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 18 for installing conduit and wiring system in remodeling of main building, United States Public Buildings Boston. For further information address above.

CONCORD, MASS.—It was voted at a recent town meeting to appropriate $50,000 for improvements to the municipal electric light plant.

HOLYOKE, MASS. — The New England Tire & Rubber Company contemplates the erection of an electric power house to be used in connection with a new factory to be located on Main Street. The total cost is estimated at about $300,000.

SPENCER, MASS. — The Chamber of Commerce will consider the proposition to have the Spencer Gas Company, which has the electrical and gas rights of Spencer, install an emergency power plant in its Elm Street plant. The company purchases electrical energy from the Massachusetts Central Company and in turn distributes it to the town.

WAKEFIELD, MASS. — The Heyward Brothers & Wakefield Company contemplates the erection of a power house at its local furniture factory.

NORWICH, CONN. — Bids will soon be received by the United States Finishing Company for the erection of a proposed new electric power plant at its textile mills, to cost about $400,000. Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia, Pa., are engineers.

WATERBURY, CONN.—The Connecticut Light & Power Company has applied for permission to erect poles, wires and fixtures on South Riverside Street.

Middle Atlantic States

BUFFALO, N. Y.—Julius Schultz, architect, 1370 Main Street, is preparing plans for the erection of a power house to cost about $10,000.

BUFFALO, N. Y.—The Bureau of Water contemplates the purchase of thirteen three-phase, 2,300-volt switchboard panels and one multi-stage centifugal type pump, rating 250 gal. per minute, with 10-ft. suction head capable of discharging against a head of 700 ft. A. W. Kreinheder is Commissioner of Public Works.

DE RUYTER, N. Y. — Application has been made to the State Public Service Commission for permission to erect, maintain and operate a municipal electric lighting system in this village.

MALONE, N. Y.—The Malone Light & Power Company has been authorized by the State Public Service Commission to issue $100,000 in bonds for improvements and extensions to the company's property.

SCHENECTADY, N. Y. — Extensions to the street-lighting system on various streets of the city have been authorized by the Common Council.

ULSTER, N. Y.—Charles P. Dickinson, of Ellenville, contemplates the erection of an electric light plant in Ulster and also extension to the electric plant in Rosendale.

OCEAN CITY, N. J. — Negotiations are being arranged by the City Commission with the Atlantic City Electric Light Company for improved lighting service along the boardwalk.

ARDMORE, PA.—The Counties Gas & Electric Company has applied to the Public Service Commission for permission to issue $486,000 in bonds, part of which will be used for proposed extensions to its electric plant and system.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

KINGSTON, PA.—Application has been made to the Public Service Commission by the Luzerne County Gas & Electric Company for permission to issue $1,150,000 in bonds for improvements and extensions to its electric plant.

OIL CITY, PA. — The Citizens' Traction Company has applied to the Public Service Commission for authority to issue $59,000 in bonds for extensions and betterments to its electric plant.

PALMERTON, PA.—The Public Service Commission has granted permission to the Palmerton Lighting Company to issue $70,000 in stock, the proceeds to be used for improvements to its plant.

PHILADELPHIA, PA.—Plans have been filed by Henry Disston & Sons, Inc., of Tacony, for the erection of an electric substation at its saw and file works on Milner Street, to cost about $15,000.

PITTSBURGH, PA.—The Council of Ben Avon has authorized the installation of a new lighting system in that town. Plans call for sixty-five lamps of 100-cp., thirty lamps of 200-cp. and an indefinite number of 400-cp. lamps.

WILLIAMSPORT, PA. — The Lycoming Edison Company has made application to the Public Service Commission for permission to issue $123,000 in notes for proposed extensions and improvements to its plant and system.

YORK, PA.—The erection of two automatic electric substations is being planned for by the York Railways Company.

BALTIMORE, MD. — A special election will be held on Nov. 2 for the purpose of voting on an issue of $26,000,000 in bonds for municipal extensions and improvements, including an electric street-lighting system.

FROSTBURG, MD. — Arrangements are being made by the Brophy Coal Company of Midlothian for the installation of new electrical equipment, including motors and electrically operated dumping apparatus.

HAGERSTOWN, MD.—The erection of a local substation and a 33,000-volt transmission line in New Market and Monrovia is under consideration by the Hagerstown & Frederick Railway Company.

BLUEFIELD, W. VA.—The installation of new electrical equipment, to cost about $40,000, at the properties of the Point Lick Coal Company is contemplated.

WILLIAMSON, W. VA. — Arrangements have been made by the Williamson Electric Company for an issue of $160,000 in bonds for proposed extensions and betterments to its electric power plant and system.

SHIPMAN, VA.—The Red Apple Orchard Company contemplates the erection of a power house to be used in connection with its local canning plant.

WASHINGTON, D. C.—Bids will be received at the office of the Chief of Bureau of Yards and Docks until Aug. 11 (Specification 4239) for furnishing five 40-ton electric traveling cranes for shipbuilding slips at the navy yards at New York, Philadelphia and Norfolk. For further information address the above.

North Central States

DETROIT, MICH.—The Board of Water Commissioners, 232 Jefferson Avenue, has awarded contract to Martin & Krausman, 747 Garland Avenue, for the erection of a machine shop, at a cost of $21,180. Individual motors and electric lighting equipment will be installed.

SUNFIELD, MICH.—A committee has been appointed to investigate various lighting outfits suitable for a town the size of Sunfield.

CLEVELAND, OHIO. — Ordinances have been passed authorizing the expenditure of $400,000 for the purpose of erecting, enlarging and extending the municipal electric light and power system as follows: Purchase of a turbo-generator, $180,000; condenser equipment, $76,000; auxiliary equipment, $10,000; switchboard equipment, $18,000; wire and cables, $35,000; transformers and equipment, $25,000; meters, $18,000; service equipment, $10,000; pole and line equipment, $7,000, etc.

LIMA, OHIO. — The City Council has under consideration an issue of $180,000 in bonds for the installation of boulevard lights.

HARRODSBURG, KY.—Improvements to the municipal electric light and waterworks are contemplated. Pease, Greeley & Hensen, Chicago, Ill., are engineers.

LOUISVILLE, KY.—Arrangements have been made by the Louisville Gas & Electric Company for an issue of $3,500,000 in notes for extensions and improvements to its electric power plants and systems.

FORT WAYNE, IND.—Extensions to the street-lighting facilities are being planned for by the Fort Wayne Development Company.

GOSHEN, IND. — The power plant and other buildings of the Hartwell Coal Mining Company, it is reported, have been destroyed by fire, causing a loss of about $45,000.

CHICAGO, ILL. — The Commonwealth Edison Company, 72 West Adams Street, is having plans prepared for the construction of two reactor buildings, the first 15 ft. x 350 ft., to be erected at the Fisk Street plant, and the other 20 ft. x 200 ft., to be inside the Northwest plant at Roscoe Street and North California Avenue.

DECATUR, ILL.—An ordinance has been passed authorizing the installation of an ornamental street-lighting system on Cobb Avenue.

OTTAWA, ILL.—A meeting of the residents of Ottawa is being arranged for the purpose of considering the installation of an ornamental street-lighting system on the east side. Estimates show an expenditure of about $30,000 would be required for such an improvement.

CEDARBURG, WIS. — Bids will be received by Fred Schuette, city clerk, until Aug. 24, for the erection of a reservoir and pumping station; also for one air compressor, one 300-gal.-per-minute motor-driven centrifugal pump, one 60-hp., two-phase, 60-cycle, 440-volt motor, etc.

MILWAUKEE, WIS. — Plans have been filed with the Department of Public Works for the installation of underground conduits, carrying ten cables, for conveying electric energy into Milwaukee from the new $8,000,000 power plant of the Milwaukee Electric Railway & Light Company, near St. Francis, now under construction.

GRAND RAPIDS, MINN.—The installation of an ornamental lighting system on Main Street is contemplated by the village officials.

PLANKINTON, S. D.—A conference has been held by the owners of the electric light plants at White Lake, Stickney and Mount Vernon for the purpose of discussing the establishment of a central lighting plant to supply electricity to the three towns, thus doing away with two plants. It is probable that Plankinton may be selected as the site for the central plant.

WAKEENEY, KAN. — Bonds to the amount of $65,000 for the erection and equipping of a new municipal power house have been voted. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are engineers.

Southern States

ASHEVILLE, N. C. — The Asheville Power & Light Company plans to remodel and enlarge its plant at a cost of about $100,000. John D. Caldwell is superintendent.

MURPHY, N. C.—An ordinance has been authorized for an issue of $25,000 in bonds for the completion of an electric light and power plant in the town of Murphy.

PICKENS, S. C. — The Pickens Cotton Mill plans the installation of an electric lighting and power system at its plant.

TOWNVILLE, S. C.—A company is being organized by Frank McLeese for the purpose of installing and operating a local electric power system and the erection of a transmission line from Portman to Townville. The new company will purchase energy from the Southern Utilities Company of Anderson.

ST. PETERSBURG, FLA.—Contract has been awarded to the Leneave Electric Company of St. Petersburg for the erection of 102 electric lamps on Central Avenue, to cost $19,500. Iron poles will be used.

TILLAR, ARK. — Application has been made to the Arkansas Corporation Commission by the Tillar Light & Power Company for a certificate of convenience and necessity to erect an electric transmission line from Tillar to Winchester for furnishing electricity to the latter town.

MOUNTAIN VIEW, OKLA. — Bonds to the amount of $30,000 have been voted for the erection of an electric light plant in Mountain View. T. E. Givens is city clerk.

SAN ANTONIO, TEX.—H. D. Kellar, of Coldwater, Mich., contemplates the installation of an electric light plant.

Pacific and Mountain States

OAK HARBOR, WASH.—C. A. Strong, manager of the Western Electric Company of Bellingham, with several expert electricians, has been making a survey in Oak Harbor for an electric light plant. It is proposed to secure power from a creamery company which is ready to provide room for a dynamo and supply power from its 40-hp. boiler and engine.

RAYMOND, WASH.—The Willapa Electric Company of Raymond has purchased the Willapa Power Company for $50,000. The new owners will proceed immediately to extend its lines for furnishing power to the various industrial plants in the vicinity.

LOS ANGELES, CAL.—The city has filed application with the State Water Commission for appropriation of streams for new power plants as follows: For storage basins in the Kings River district, Kern County, total 225,000 acre-feet per annum, to develop power at contemplated plants to be known as Plant No. 1, No. 2 South, No. 2 North and No. 3; the plants will develop 15,000 hp., 156,000 hp., 85,000 hp. and 40,000 hp. respectively; for storage basin in the middle and south forks of the Kings River, contemplated to hold 20,000 acre-feet per annum; for power plant to develop 170,000 hp.; storage basin in Rock Creek, Mono County, to develop a 15,000-hp. electric plant. Other sites to furnish storage basins are Tuolumne County, to develop 159,700; Mariposa and Madera Counties, a total of 156,300 hp., and Tulare County, 150,000 hp. This extensive program is pending, subject to the decision of the Supreme Court, which will establish the legality of the $13,000,000 in bonds voted last year for the municipal distribution of power. The development of the system will be gradually undertaken for completion to meet the needs of the city of Los Angeles.

MILL VALLEY, CAL.—An election has been held for the purpose of voting on the formation of a lighting district to be known as the Tamalpais Valley Public Highway Lighting District. R. E. Graham is clerk.

BOUSE, ARIZ. — Application has been filed with the State Water Commissioner by R. M. Stene and associates of Bouse for permission to harness Williams River for the purpose of generating electric energy to supply mines in Mohave County and to irrigate land in Yuma County.

CASA GRANDE, ARIZ. — The Chamber of Commerce is considering the possible establishment of a new electric system in this place. It is proposed that the farmers of the valley organize an electric power district and bond their lands for a sum sufficient to erect a power plant and distribution system to care for all pumping plants and to supply electric energy for other purposes.

FORT STANTON, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 16, for remodeling power house, boiler plant, etc., at the United States Sanitarium, Fort Stanton. Drawings and specifications may be obtained from the custodian at the sanitarium or at the Washington address.

Canada

FORDWICH, ONT. — Bids will be received by the Town Council, care of J. H. Rogers, until Aug. 17, for the installation of a hydro-electric lighting and power distribution system, to cost about $10,000.

LONDON, ONT.—The installation of an electric motor and waterworks electric pumping equipment will be made in a new school now under construction in London. W. G. Murray, Dominion Savings Building, is in charge.

Record of Electrical Patents

Notes on United States Patents

(Issued July 13, 1920)

1,346,128. DEVICE FOR ATTACHMENT OF ELECTRIC CONDUCTORS TO INSULATORS; Frederick H. Krebs, Frederiksberg, near Copenhagen, Denmark. App. filed June 4, 1919. For quick attachment or detachment.

1,346,223. ELECTRIC ARC FURNACE; Lamberto Lombardi, Rome, Italy. App. filed Jan. 27, 1919. Arc blown against material by magnetic field.

(Issued July 20, 1920)

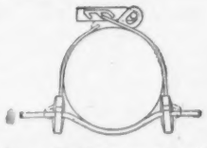
14,921 (reissue). TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed Dec. 31, 1918. Perforated-tape system.

1,346,821. DYNAMO FOR LIGHTING AND MOTOR IGNITION; Emile F. Girardeau, Paris, France. App. filed Oct. 15, 1915. Single armature for ignition and lighting.

1,346,849. ELECTROLYTIC CELL; Robert M. Shaw, St. Louis, Mo. App. filed July 29, 1918. For separating fluids into their component gases.

1,346,854. ELECTRIC FURNACE; Edwin L. Smalley, East Orange, N. J. App. filed Oct. 21, 1919. Easily removable heating elements.

1,346,860. ELECTRICAL PLUG CONNECTOR; William C. Tregoning, Cleveland, Ohio. App. filed March 24, 1917. Conductors easily soldered to plug.



1,346,128. Device for Attachment of Electric Conductors to Insulators

1,346,874. RESISTANCE MATERIAL; Harry T. Bellamy, Oak Park, Ill. App. filed Nov. 16, 1918. Insulating material for use with heating elements.

1,346,994. SIGNAL; Frank H. Thone, Bingham Canyon, Utah. App. filed March 3, 1919. Automobile direction indicator.

1,347,002. ELECTRIC IMPULSION MOTOR; M. E. A. Baule, Lyons, France. App. filed May 1, 1919. Electric magnet motor.

1,347,013. TOASTER; Lloyd G. Copeman, Flint, Mich. App. filed Oct. 31, 1919. Grid readily removed.

1,347,026. APPARATUS FOR EXTRACTING METAL FROM ORES AND THE LIKE; Harold H. Godfrey, Los Angeles, Cal. App. filed Aug. 4, 1919. For gold precipitation, etc.

1,347,049. CORRECTING CIRCUITS FOR HIGH-DISTORTION LINES; William H. Martin, New York, N. Y. App. filed June 18, 1918. Keeps zero from wandering.

1,347,069. AUTOMATIC TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed April 10, 1916. Automatic two-wire systems.

1,347,088. ELECTROLYTIC APPARATUS; William E. Greenawalt, Denver, Col. App. filed Feb. 1, 1917. Electrolysis of liquids having gas in solution.

1,347,089. APPARATUS FOR TREATING LIQUIDS WITH GASES; William E. Greenawalt, Denver, Col. App. filed March 25, 1915. Recovery of metals from volatile fumes.

1,347,102. RESISTANCE DEVICE; Leonard Kebler, Bronxville, N. Y. App. filed Oct. 23, 1915. Resistive conductor covered by insulating coating.

1,347,175. TELEPHONE INSTRUMENT; Frank J. Reichmann and John Press, Chicago, Ill. App. filed June 21, 1918. Amplifier in loud-speaking circuits.

1,347,176. TELEGRAPH SIGNALING SYSTEM; Harry O. Rugh, Chicago, Ill. App. filed May 8, 1919. Signal of the buzzer type.

1,347,177. ELECTRIC APPARATUS FOR HEATING AND VAPORIZING HYDROCARBON FUELS; Edward Saslow, Muskegon, Mich. App. filed Feb. 16, 1920. For internal-combustion engines.

1,347,184. ELECTRIC ARC-WELDING MACHINE; Reuben S. Smith, Milwaukee, Wis. App. filed May 17, 1920. Covering applied to electrode while welding.

1,347,189. RECOVERY OF ZINC BY ELECTROLYSIS; Royale H. Stevens, Hobart, Tasmania, Australia. App. filed Nov. 11, 1919. From zinc sulphate solution obtained by leaching ores, etc.

1,347,209. DOUBLE-COIL OSCILLATING MOTOR; Loren O. Crenshaw, Los Angeles, Cal. App. filed May 7, 1919. For railway signals.

1,347,239. TROLLEY FINDER; William F. Yancey, Portsmouth, Va. App. filed July 15, 1919. Prevents arm rising above wire.

1,347,250. ELECTROCHEMICAL PROPELLING AND TRANSMITTING MECHANISM; Absolem F. Clark, Los Angeles, Cal. App. filed March 27, 1917. For motor vehicles.

1,347,258. ELECTRICAL SIGNALING SYSTEM; Arthur T. Dawson and George T. Buckham, Westminster, London, England. App. filed May 29, 1918. For gun-fire control, etc.

1,347,278. METHOD OF ELECTRICALLY WELDING METAL PLATES; Charles H. Kicklighter, Macon, Ga. App. filed May 5, 1920. Welds through small piece of metal between plates.

1,347,305. MOTOR CONTROL; William G. Taylor, Schenectady, N. Y. App. filed May 29, 1917. Drive of embossing machines.

1,347,323. AUTOMATIC BATTERY-CHARGING SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed Dec. 14, 1918. Controlled by current through artificial load.

1,347,328. RADIO-SIGNALING SYSTEM; Alfred N. Goldsmith, New York, N. Y. App. filed March 29, 1917. For controlling the amplitude of oscillations.

1,347,378. SPARK-GAP INDICATOR; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Jan. 12, 1920. To give automatically sensible indication of weakening or break-down in insulators.

1,347,378. Spark-Gap Indicator

1,347,421. ELECTRICAL INDICATOR; Fred W. Temple, Kalamazoo, Mich. App. filed Sept. 25, 1917. House number light and bell.

1,347,423. FLASHLIGHT; Joseph Vince, Brooklyn, N. Y. App. filed Sept. 18, 1919. Spring assures good contacts.

1,347,440. APPARATUS FOR PROPAGATING AND INTENSIFYING ELECTRICAL OSCILLATIONS; John J. Callaghan, Livermore, Cal. App. filed Nov. 11, 1918. Approaches frequency of light waves.

1,347,457. FEEDING POLYPHASE-CURRENT CIRCUITS WITH MONOPHASE CURRENT; Herbert Gutzwiller, Schonenwerd, Switzerland. App. filed Aug. 5, 1918. Splits current by commutator.

1,347,460. MEANS FOR SUPPLYING LIGHTING AND IGNITION CURRENT FOR AUTOMOTIVE VEHICLES; John A. Heany, Flint, Mich. App. filed July 27, 1910. Constant-current generator.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 11-15.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Cleveland, Ohio, Sept. 30-Oct. 2.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, New York, Sept. 20-24.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-Treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Cleveland, Oct. 4-7.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind. Annual convention, Sept. 15-17, French Lick, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, New Orleans, La., Oct. 19-22.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich. Annual convention, Ottawa Beach, Mich., Aug. 24-26.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 4-8.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive assistant to president, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb. Annual meeting, Omaha, Neb., Sept. 8 and 9.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Kineo, Me., Sept. 14-16.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION, N. E. L. A. Secretary, M. Barnett, St. Paul, Minn.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash. Annual convention, Spokane, Wash., Sept. 8-11.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. H. Halloran, Rialto Bldg., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 8-11.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN DIVISION, N. E. L. A. Secretary-treasurer, A. C. Cornell, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 Fifth Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Miami, Fla., Nov. 17-19.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual convention, Detroit, Mich., Jan. 25-27, 1921.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Bldg., Milwaukee, Wis.